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HARTMANN (H. T.). **Tests with new copper fungicides with special reference to injury, tenacity to foliage, and dwarfing effect.**—*Proc. Amer. Soc. hort. Sci.*, xxxviii, pp. 148–152, 1941.

Comparative tests were made in 1939 and 1940 at the Missouri Agricultural Experiment Station on apple and cherry trees with various new proprietary copper-containing sprays, Bordeaux mixture, and lime-sulphur to obtain information as to the toxicity of these materials to fruit and foliage, the degree of control obtained against cherry leaf spot (*Coccomyces hiemalis*), and their effects on the size of cherry fruits on treated trees. The results [which are tabulated] showed that Bordeaux mixture (6–8–100) exercised a dwarfing effect on the fruit and foliage of sour cherries, and when used early in the season on apples caused foliage-burning and fruit-russeting. Bordeaux mixture, cupro K (copper oxychloride: Röhm and Haas Co.), yellow cuprocide (yellow cuprous oxide: Röhm and Haas Co.), and spray cop (basic copper sulphate: General Chemical Co.) gave satisfactory control of *C. hiemalis* [*R.A.M.*, xx, p. 170]. Bordeaux mixture and copper phosphate showed the largest initial deposit of copper on the leaves and had the best adhesive qualities of the materials tested. Two materials offered promise as substitutes for Bordeaux mixture in their control of *C. hiemalis* and innocuousness to the trees, viz., cupro K (3–100) and spray cop (1½–100).

REEVES (E. L.). **Mottle leaf, a virus disease of Cherries.**—*J. agric. Res.*, lxii, 9, pp. 555–572, 8 figs., 1941.

Mottle leaf of cherries [*R.A.M.*, xv, p. 664; cf. xix, p. 416], stated to be a virus disease transmissible only by grafting and similar processes, is reported from Washington, Oregon, Idaho, California, and British Columbia attacking, as far as is known, only four commercial varieties (Bing, Napoleon, Waterhouse, and Lambert) in the field. The disease is believed to have been present in the Pacific Northwest for more than 20 years. The symptoms of the disease vary considerably in different varieties and even in different trees of the same variety. Diseased trees exhibit puckered, misshapen, and mottled leaves, eventually become stunted, and produce no marketable crop after three or more years. Some of the chlorotic spots on the leaves drop out but there is no premature defoliation. Of the 19 cherry varieties inoculated none was immune from mottle leaf, although many were quite tolerant.

Attempts to transmit the disease to other stone fruits by budding were mostly unsuccessful (with the exception of one transmission from cherry to peach in the greenhouse) owing to failure to achieve growth union. The disease was transmitted from cherry to cherry by budding, symptoms appearing after 14 days in the greenhouse and 37 in the field. Attempted transmission by mechanical means or through *Myzus cerasi* was unsuccessful, and the manner of spread of the virus remains unknown. Hot water treatment of bud sticks at 46° C. for 60 minutes and at 49° for ten failed to inactivate the virus. Since no tree showing definite leaf symptoms is known to have recovered, the removal of diseased trees from the orchard is recommended as a measure of controlling the spread of the disease.

Reid (R. D.). **Red core disease of the Strawberry.**—*Scot. J. Agric.*, xxiii, 3, pp. 264–272, 1941.

After stating that strawberry red core disease (*Phytophthora fragariae*) [*R.A.M.*, xix, p. 608] is now known to occur in 18 counties in Scotland (in some of which only a few outbreaks have been recorded), in 5 counties in England, and in 11 States of the American Union, the author gives details of research work on control carried out since 1929 by the Department of Agriculture for Scotland in association with the West of Scotland Agricultural College. Three lines of investigation have been followed, viz., cultural improvement, chemical treatment, and selection and breeding for resistance.

With regard to the first, improvement in the standard of cultivation may be desirable in many cases, but it would be quite erroneous to think that cultural improvement in itself will eliminate the disease [cf. ibid., vii, p. 384]. Chemical methods have so far given disappointing results. Breeding work has resulted in the release to growers of five seedling varieties (notes on the fruiting characters of which are given), viz., Auchincruive, 1, 2, 4, 5, and 6 [ibid., xx, p. 215]. During the first five years' tests no infection was shown by any of these, but in the last three years occasional plants have shown slight infection. Damage is often associated with highly unfavourable soil conditions, and is accompanied or preceded by the presence of weak parasites. The total proportion of plants affected has been small, but the possibility that resistance may decline cannot be disregarded, and in a footnote the author states that evidence is to hand indicating that in certain cases breakdown of resistance may be more serious than was anticipated.

Under practical field conditions, however, the resistance shown by these varieties in contrast with ordinary commercial varieties is striking. They have been tested widely throughout western Scotland, and generally appear to be virtually immune. Tests with four of these varieties in Illinois showed them to be completely resistant under American conditions. Similar results were obtained in Maryland. C. J. Hickman in tests made in Kent under very severe conditions found three of the varieties to be entirely resistant, and a fourth very nearly so. All these varieties, however, are very susceptible to yellow edge and crinkle [ibid., xix, p. 716]. Large-scale tests also demonstrated that the variety known in America as Aberdeen is also resistant to red

core in Scotland; this has now been released under the name of American Aberdeen.

Iyriboz (N.). **Incir hastaliklari.** [Fig pests.]—*Publ. Minist. Agric. Turk. Rep.* 489, 88 pp., 33 figs., 1940.

Included in this annotated list of fig pests and diseases are six pages dealing with 15 pathogens of the crop in Turkey and elsewhere.

Nueva maquina para el combate de la Sigatoka. [A new machine for the control of 'Sigatoka'.]—*Rev. agríc., Guatemala*, xviii, 1, pp. 25–27, 4 figs., 1941.

A new portable spraying apparatus for the treatment of 'Sigatoka' disease of bananas [*Cercospora musae*] has recently been devised by the proprietors of a plantation in San Felipe, Retalhuleu, Guatemala [*R.A.M.*, xix, p. 551]. The machine is provided with a 3 h.p. motor, a wooden tank of 100 gals. capacity, and two rubber hoses 50 ft. long and 1 in. in diameter, each capable of discharging from its nozzle 3 gals. 5–5–50 Bordeaux mixture per minute at a pressure of 300 lb. per sq. in. The machine covers an acre per hour and the cost of the treatment, allowing for two applications a month during the growing period, is estimated at 0·07 quetzals [1 quetzal=about 4*s.* 1*d.* at par] per rhizome.

Stevens (H. E.) & Piper (R. B.). **Avocado diseases in Florida.**—*Circ. U.S. Dep. Agric.* 582, 46 pp., 15 pl., 1 graph, 1941.

This is an important, very well-illustrated contribution to the knowledge of the symptomatology, etiology, mode of infection, and control of avocado diseases in Florida, where the acreage under the crop is stated to be expanding and interest in it increasing.

Scab (*Sphaceloma perseae*) [*R.A.M.*, xvii, p. 760; xix, p. 366] is widespread and severe, causing up to 100 per cent. fruit infection on susceptible varieties of West Indian, Guatemalan, and West Indian-Guatemalan hybrid extraction, such as Lula; Pollock, Collinson, Waldin, Collins, and Gottfried, on the other hand, are highly resistant. As a result of six years' experiments in the control of the disease in a commercial grove at Lake Placid, the following schedule (subject to modifications to suit the conditions of a particular season) has been evolved and should prove generally effective: 3–3–50 Bordeaux mixture (1) dormant, just before or immediately after flower bud appearance; (2) near the end of the blossom, when small fruits are visible; (3) two to four weeks after (2); (4) three to four weeks after (3); (5) a month after (4), the two last being necessary only in wet seasons.

Cercospora purpurea is probably responsible for heavier damage to the crop than any other single disease, being practically ubiquitous on the leaves, fruit stems, and fruits of the Fuerte, Waldin, Winslowson, Trapp, Lula, Wagner, Taylor, Nobal, Pollock, Eagle Rock, and West Indian seedlings. On the leaves the fungus produces purplish, later brown, first raised, then sunken, scattered or coalescent spots, those on the fruits commencing as greenish-white dots and expanding into slightly sunken, irregular, brown to dark brown blotches, $\frac{1}{8}$ to $\frac{1}{4}$ in. in diameter, often merging into areas of dead rind tissue deeply fissured by surface cracks. Infected leaves are the principal source of perpetuation of *C. purpurea*, the perfect stage of which, occasionally found in

large, necrotic lesions on mature foliage, appears to be a *Mycosphaerella*. Inoculations with the latter have resulted in the development of typical fruit-spotting, but natural infection is attributable mainly to the *Cercospora* conidia, which are formed in profusion during warm, rainy weather, and distributed over long distances by wind and insects, and through the individual trees in drops of rain or heavy dew. The critical period for attacks on the fruit is between mid-May and late August, when it is a quarter to three-quarters mature, corresponding to the time of maximum spore production. After the fungus has entered the rind, an incubation period of 30 to 40 days elapses before the appearance of any external symptoms, and another 10 to 15 days until spore formation. The following schedule is recommended for the joint control of *C. purpurea* and the causal organism of black spot or anthracnose (*Colletotrichum gloeosporioides*) [ibid., xix, p. 135; xx, p. 268]: 4–4–50 Bordeaux mixture (1) between 1st and 15th May, care being taken to ensure full coverage of the leaves and fruits; (2) not later than a month after (1); (3) a month after (2), this treatment being required only on varieties not maturing until the winter or early spring.

Stem-end rots of minor economic importance are caused by *Diplodia natalensis* [ibid., xii, p. 707], a *Phomopsis* distinct from *P.* [*Diaporthe*] *citri*, and a *Dothiorella* apparently different from that responsible for a serious decay of the avocado crop in California [namely, from *D. gregaria*, the imperfect stage of *Botryosphaeria ribis* var. *chromogena*: ibid., xv, p. 238].

Collar rot is due to a *Phytophthora* of the *P. parasitica* group [ibid., xiv, p. 707], while other diseases of a relatively innocuous character include powdery mildew (*Oidium* sp.), rusty blight (*Gloeosporium* sp.) [ibid., iv, p. 653], fruit-russeting, possibly caused by a *Phomopsis* allied to *Diaporthe citri*, algal leaf spot (*Cephaleuros virescens*) [*C. mycoidea*: ibid., xix, p. 135], tipburn of the leaves, sun scald, and sun blotch [ibid., xviii, p. 694].

CHRISTOPHER (E. P.). **The Bordeaux formula in horticultural research.** —*Proc. Amer. Soc. hort. Sci.*, xxxviii, pp. 153–156, 1941.

Lack of uniform agreement among horticultural workers as to the precise meaning of any given formula for Bordeaux mixture induced the author to send out a questionnaire to workers in 40 different institutions in the United States and Canada to ascertain what they understood by the formula 'Bordeaux mixture 4–4–50'. At least 73 replies were received to most of the questions. The striking differences noted in the answers to any one question indicated a glaring source of error in experimental results obtained from the use of Bordeaux mixture, and it is concluded that a uniform interpretation of the formula for Bordeaux mixture is highly desirable. All results involving the use of the mixture should include a definite statement on formula interpretation and mixing methods.

ABRAHAM (E. P.), CHAIN (E.), FLETCHER (C. M.), GARDNER (A. D.), HEATLEY (N. G.), JENNINGS (M. A.), & FLOREY (H. W.). **Further observations on penicillin.**—*Lancet*, ccxli, 6155, pp. 117–189, 2 figs., 2 diags., 4 graphs, 1941.

This paper gives a detailed, well-documented review of the authors'

work at the Sir William Dunn School of Pathology and Radcliffe Infirmary, Oxford, on the large-scale production, assay, activity, and therapeutic trials on human subjects of penicillin, a bacteriostatic principle produced by *Penicillium notatum*. Penicillin exerts a selective action on certain Gram-positive bacteria, one to two parts per million inhibiting the growth of *Streptococcus pyogenes*. It is unaffected by pus, serum, or protein autolysates and is without toxic effect on leucocytes or delicate living tissues. [This work is also summarized and discussed in an editorial article on pp. 191–192.]

Radtchenko (S. I.). Новая методика выращивания растений при разной температуре почвы и воздуха. [A new technique of growing plants under different temperatures of air and soil.]—*Acta Inst. bot. Acad. Sci. U.R.S.S.*, Ser. IV, Bot. Exp., v, pp. 55–71, 13 figs., 1941. [English summary.]

A detailed description is given of a technique for growing plants under controlled conditions of air and soil temperature.

Russell (E. J.). **The function of applied biology in war time.**—*Ann. appl. Biol.*, xxviii, 2, pp. 170–174, 1941.

In a discussion at a meeting of the Association of Applied Biologists held on 6th December, 1940, the author, in the opening speech, reviewed the problems to which biology contributes in war-time, discussing in some detail the protection of food and material against deterioration, and activities aiming at increasing the food supply.

Lentz (P.). **Molds found in Indianapolis markets.**—*Bot. Stud. Butler Univ.*, v, Paper 4, pp. 58–66, 1941.

Among the 21 genera of moulds isolated from fruits and vegetables obtained from Indianapolis (Indiana) markets from 15th September to 15th December, 1939, *Penicillium*, *Rhizopus*, *Aspergillus*, and *Alternaria* predominated, followed by *Oospora*, *Fusarium*, *Monilia*, *Monosporium*, and *Isaria*. It was not feasible to make any very definite correlation between the fungi and the different types of hosts, but *Alternaria* and *Fusarium* seemed to prevail on hosts growing in or near the soil; *Aspergillus* and *Monilia* on ordinary orchard fruits; while *Penicillium* was the only genus found on citrus fruits [cf. *R.A.M.*, xvi, p. 558]. Grapes yielded a species of *Melanconium*, the occurrence of which in Indiana constitutes a departure from its normal range. *Mucor* was isolated only once, from carrots. Species of the following genera, not hitherto identified in association with uncooked fruits and vegetables in the Butler laboratories, were isolated in the course of these studies: *Isaria*, *Haplaria*, *Synsporium*, *Monacrosporium*, *Trichosporium*, *Sporotrichum*, *Acremoniella*, *Graphium*, *Pachybasium*, and *Spicaria*.

Crowell (I. H.). **A tweezers method for making microscopic sections of plant pathological material.**—*Mycologia*, xxxiii, 3, pp. 335–337, 6 figs., 1941.

For making preparations of diseased plant material, the author uses forceps about 3 in. long with either straight or curved ends sharpened to a knife edge, which permits the infected epidermis to be cut through

and then stripped off and mounted with a minimum of disturbance in lactophenol or glycerine jelly. The stripping of fine hair-like strands may be performed in a plane at right angles to the leaf surface of grasses and other monocotyledons to show the relationship of submerged stromata to the host tissue.

FRAHM-LELIVELD (J. A.). **A triple stain method for mycorrhiza in root cells.**—*Natuurwet. Tijdschr. Ned. Ind.*, ci, 4, pp. 114–115, 1941.

The following cytological method was employed at the Central and East Java Experiment Station, Malang, in the study of root cells of *Asarum europaeum* [asarabacca, a medicinal plant] infected by a mycelium of the *Rhizoctonia* type. The material is fixed for 24 hours in 1 part 2 per cent. osmic acid solution and 2 parts each of 1 per cent. chromic acid and 3 per cent. potassium bichromate; after 30 minutes' rinsing in distilled water the pieces are transferred to a mixture of 1 part pure pyroligneous acetic acid and 1 per cent. chromic acid for 24 hours, followed by another half-hour's rinsing. Post-chromatization is effected by three to six days' immersion in 2 per cent. potassium bichromate, after which the material is washed out for 24 hours in tap water, dehydrated, and embedded in paraffin. The unbleached microtome sections were stained with methyl (cotton) blue and safranin in lactophenol-alcohol. The cell walls, part of the protoplasmic contents, the secondary thickenings of the wood vessels, and the walls of the living mycelium in the host cells stain red; the mycelial contents stain blue, and the glomerules of ingested hyphae black. In the external cortical cells that serve as host cells, only the outer walls and the starch grains stain blue and their contents remain unstained, whereas in the layers in which ingestion proceeds the grains are uniformly swollen and usually burst, the walls staining blue and the contents red.

KÖHLER (E.). **Eine übersehene Kartoffelvirose.** [An overlooked Potato virus.]—*Naturwissenschaften*, xxix, 26, p. 390, 1941.

In addition to leaf roll, potato samples from Silesia, Mark Brandenburg, Saxony, and Berlin were found on examination at the Biological Institute, Dahlem, to be extensively infected by a virus transmissible by means of the aphid *Myzus persicae* and grafting, but not through the juice. In field crops the virus appears to be virtually latent, but in combination with other viruses it provokes severe crinkle, sometimes accompanied by stunting, and is largely responsible for 'degeneration'.

In greenhouse plants raised from 'eyes', the first symptom of the disease is a pronounced upward rolling of the pinnae, similar to that associated with leaf roll but usually only transient; the leaves, moreover, remain soft and pliable and do not develop the chlorosis characteristic of leaf roll. In the Altgold and Wohltmann varieties the longitudinal growth of the shoots becomes accentuated, while in Altgold and Ackersegen the leaves are abnormally small and the pinnae exceptionally small and narrow. The foliage displays a faint, diffuse, yellowish-green tinge originating in the mid- and lateral veins of the pinnae and imparting to the entire plant a somewhat lighter aspect than that of normal stands. Anthocyanin spots are produced on the rolled leaves of Parnassia and Wohltmann.

Since severe crinkle is a typical symptom of the virus in mixed infections, the designation K (Kräusel) is proposed for it. The disease under discussion is obviously identical with that described by the writer in 1935 as 'rolling mosaic' [*R.A.M.*, xv, p. 246].

HEINZE (K.). **Die Entwicklung des Pfirsich- und Aprikosenanbaus in Deutschland bis zum Jahre 1938 als Ursache für die allmähliche Zunahme der Kartoffelvirosen.** [The development of Peach and Apricot cultivation in Germany up to the year 1938 as a cause of the gradual increase of Potato viruses.]—*Forschungsdienst*, xi, 1, pp. 50–59, 6 maps, 1941.

Official statistics are cited in support of the author's statements concerning the rapid and widespread extension of peach and apricot cultivation of recent years in Germany, a development calculated, if allowed to proceed unchecked, to terminate the production of healthy stocks of seed potatoes, since the aphid (*Myzodes* [*Myzus*] *persicae*) responsible for the transmission of potato viruses overwinters in the fruit trees [*R.A.M.*, xx, p. 420]. Störmer's warning (*Mitt. Landw., Berl.*, lii, pp. 904–906, 1937) that no naturally healthy potato-growing regions would be left in Germany within a few years owing to the progress of degeneration from west to east failed to receive the attention it merited, but his fears may well be realized unless a drastic limitation of peach- and apricot-growing is enforced, at any rate along the north German coast for a distance of some 150 km. inland.

SCOTT (R. J.). **The effects of mosaic diseases on Potatoes.**—*Scot. J. Agric.*, xxiii, 3, pp. 258–264, 1941.

Investigations carried out to obtain statistical information as to the effect of the various types of mosaic disease found in Scotland, leaf roll, and 'wilding' [*R.A.M.*, xx, p. 30] upon the yield of potatoes showed that the presence of virus disease leads to earlier ripening. Negligible mottle, usually caused by mild strains of virus X, but sometimes due to virus A, may reduce the yield of ware by 16 to 25 per cent. Mild mosaic, generally caused by virus X, but very occasionally by virus A in combination with mild strains of virus X, may reduce the yield of ware by 30 to 40 per cent. Border-line severe mosaic, generally due to a combination of A and X, but also caused by severe strains of X, may reduce the yield of ware by 40 to 50 per cent. Severe mosaic, caused by a combination of A with the more severe strains of X, and by Y alone or in combination with A or X (virus Y is rather uncommon in Scotland), may reduce the yield of ware by 65 to 85 per cent. Leaf roll reduces the yield of ware by 75 to 90 per cent. While the total yield from 'wilding' types may approximate to that from normal plants, the condition reduces the yield of ware by 50 to 95 per cent.

Severe mosaic increases two- to threefold, and leaf roll fourfold from year to year.

Methods for controlling the mosaic group comprise the use of varieties virtually immune from A and X (e.g., King Edward, Epicure, Ninetyfold, Edgecote Purple, International Kidney, and Craig's Defiance), the planting of the highest grade 'seed', adequate isolation, care being taken never to plant X- near A-carriers, thorough roguing, especially

in the early part of the season, and roguing for mild forms of mosaic as drastically as for the more severe. Leaf roll and 'wildings' are controllable by the use of high grade seed and thorough roguing.

LARGE (E. C.). **Potato blight.**—*J. Minist. Agric.*, xlviii, 1, pp. 22–28, 1941.

In this brief popular account of potato blight [*Phytophthora infestans*] and its control, the author expresses the view that if weather conditions favour infection in 1941, it may be assumed that where preventive methods are not applied, the direct loss of crop due to blight will be from ½ to 3 tons per acre, according to the district, with an additional wastage of like amount due to the decay of affected tubers in the soil, in transit, or in clamp.

HAWKES (J. G.) & HOWARD (H. W.). **Salaman's culture of blight resistant 'Aya papa'.**—*Nature, Lond.*, cxlviii, 3740, p. 25, 1941.

Cytological examination of root tip preparations from Salaman's culture of 'Aya papa', the plant from Ecuador reported to be resistant to *Phytophthora infestans* [cf. *R.A.M.*, xix, p. 40; xx, p. 380], showed that the specimen was a pentaploid with 60–62 somatic chromosomes, and therefore confirms Reddick's suggestion that it is a hybrid between *Solanum demissum* ($2n = 72$) and *S. tuberosum* ($2n = 48$). The plant also had many morphological similarities with *S. demissum*. The original Aya papa plant collected by Knappe was found by Bukasoff and Black to be susceptible. The descriptions of these two workers do not agree with Salaman's culture. Further, one of the present authors when in Riobamba, Ecuador, ascertained that potatoes known locally as Aya papa did occur in certain districts, where they grew wild. All the evidence indicates that Knappe's Ecuadorean potato is not blight-resistant and that this quality has not yet been discovered outside Mexico.

SKAPTASON (J. B.) & BLODGETT (F. M.). **Reduced toxicity of cuprous oxide to Phytophthora infestans (Mont.) De Bary by the addition of certain insecticides.**—*Amer. Potato J.*, xviii, 6, pp. 179–180, 1941.

The results of four years' experiments on Long Island, New York, to determine the effect on the toxicity to potato blight (*Phytophthora infestans*) of the admixture with cuprous oxide of insecticides, such as pyrethrum, rotenone, and sulphur, showed an increase in the number of lesions in the plants treated with the combined preparations as compared with those dusted with copper oxide alone, but only in the case of rotenone were the figures considered to be factorially significant (F value 57·2); the other F values ranged from 14·8 to 43·5. Previous experiments (*Amer. Potato J.*, xviii, pp. 1–9, 1941) having shown that the inclusion of cuprous oxide with insecticides in no case reduced the toxicity of the latter, the present results are of some interest and may be practically significant.

BRIEN (R. M.). **'Leak', a watery wound-rot of Potatoes in New Zealand.**—*N.Z. J. Sci. Tech.*, A, xxii, 4, pp. 228–231, 2 figs., 1940.

The fungus isolated from stored potato tubers affected by the watery

wound rot commonly known as 'leak' in New Zealand was found to be identical with *Pythium ultimum* [*R.A.M.*, xiv, p. 605]. Inoculation experiments with potato dextrose agar cultures of the fungus on Arran Chief tubers gave positive results. The disease may be responsible for heavy losses under humid conditions and at a temperature range of 20° to 30° C.

RUEHLE (G. D.). **Bacterial soft rot of Potatoes in southern Florida.**—*Tech. Bull. Fla agric. Exp. Sta.* 348, 36 pp., 6 figs., 1940.

Erwinia carotovora [with which *E. phytophthora* is regarded as synonymous by some authors: *R.A.M.*, x, p. 125; xvi, p. 404; xix, p. 427] was identified as the agent of a bacterial soft rot of washed potatoes in Florida, which has been under investigation since 1936, and its pathogenicity established by inoculation experiments. In the field the development of infection is closely associated with rainy weather, causing waterlogging of the soil, and with the presence of other diseases, especially late blight [*Phytophthora infestans*], while washing the tubers and packing them in crates in a wet condition increases the risk of storage rot. The pathogen may gain ingress through cuts, bruises, or cracks made in handling, or spread from decayed to sound tubers during transit or storage. In wet soils, moreover, the bacterium may enter the tubers through the lenticels or by way of lesions produced by other agents.

By means of a specially constructed apparatus for the maintenance of fairly constant temperature and humidity, the writer carried out experiments to determine the effect of various drying methods, of chilling, and of treatment with sodium hypochlorite on the development of soft rot. The disease was controlled by rapid drying of the tuber surfaces, before or soon after packing, by four minutes' exposure to an atmosphere of 150° F., three minutes at 130° sufficing under most conditions if the air was circulated rapidly round the tubers; on the other hand, ordinary air blasts from fans or blowers do not give thorough drying on a commercial scale in an extremely humid atmosphere, the effect of the treated air being largely offset by the cooling influence of evaporation from the tuber surfaces. Since the initiation of hot air-drying in two large packing houses at Goulds, in 1939 and 1940, not a single shipment of tubers has been rejected on account of soft rot. Pre-cooling washed potatoes after the car is loaded, either with mechanical refrigeration units installed outside the car or with portable fans and ice in the bunkers, eliminated most of the decay in shipments, but these methods were both more costly and less reliable than drying with heated air. Sodium hypochlorite at dilutions of 1 in 200 or 1 in 100 failed to give adequate control of bacterial soft rot.

A study of packing-house conditions indicated that the washing of tubers by spray jets is less conducive to soft rot than immersion in tanks. In the field the disease may be combated by planting the seed pieces in well-aerated soil, spraying or dusting the growing crop with copper fungicides, and care in harvesting to reduce mechanical injuries to a minimum.

ADAIR (C. R.). **Inheritance in Rice of reaction to Helminthosporium oryzae and Cercospora oryzae.**—*Tech. Bull. U.S. Dep. Agric.* 772, 18 pp., 1941.

The results of studies at the Arkansas Agricultural Experiment Station from 1934 to 1938 on the inheritance among the progeny of crosses between a number of rice varieties of reaction to *Helminthosporium oryzae* [*Ophiobolus miyabeanus*] and *Cercospora oryzae* [*R.A.M.*, xx, p. 222] indicated that several genetic factors are operative in the case of the former disease, resistance in the particular crosses analysed (Mubo Aikoku × Supreme Blue Rose) being recessive. Time of heading and lemma and palea apex colour were inherited independently of the factors governing reaction to *O. miyabeanus*.

Supreme Blue Rose, susceptible to *C. oryzae*, was found to carry at least one factor for susceptibility dominant to the factor controlling the response of the resistant varieties, Akaho, Meshibu, and Gin Bozu (C.I. 6355 and 6873). The factor determining the reaction of the resistant varieties to *C. oryzae* is dominant to that for susceptibility in Zenith, Early Prolific, and Carolina Gold. Physiological, rather than morphological or anatomical characters appear to form the basis of differences in varietal reactions to *C. oryzae*.

SAKAMOTO (M.). **On the facilitated infection of the Rice blast fungus, Piricularia oryzae Cav. due to the wind. I.**—*Ann. phytopath. Soc. Japan*, x, 2–3, pp. 119–126, 1940. [Japanese, with English summary.]

Rice blast (*Piricularia oryzae*) [*R.A.M.*, xx, p. 275] having been observed to develop in epidemic form following rough weather, plants were subjected for several hours to an artificial strong wind prior to inoculation with the pathogen. The treatment was followed by a marked increase of infection, attributable mainly to the facilitated ingress of the fungus through abrasions resulting from interfoliar friction under the influence of the wind, though resistance may possibly have been lowered by excessive dryness or mechanical injuries brought about by the same agency.

TERUI (M.). **Internal formation of conidia of the Rice blast fungus.**—*Ann. phytopath. Soc. Japan*, x, 2–3, pp. 265–268, 1 pl., 1 fig., 1940. [Japanese summary.]

The microscopic examination of transverse sections of the leaf blades of Akage No. 3 rice plants inoculated with spore suspensions of *Piricularia oryzae* [see preceding abstract] and kept under controlled conditions in a greenhouse at the Hokkaido Imperial University, Sapporo, revealed the profuse development of hyphae, conidiophores, and conidia in some of the lysigenous cavities along the midrib. Similar observations were made in material from the leaf sheaths, while the epidermal cells, parenchymatous tissues, vascular bundles, and central hollow cavities of the culm also contained the above-mentioned organs in abundance. The conidia formed internally are shorter than those produced on the exterior of the plant, the widths being about equal in both types. Conidiophores and conidia were also formed in large

numbers on the inner surface of the bract bases. Some of the conidia developing in the lysigenous or hollow pith cavities were found to have germinated *in situ*, and presumably they would be capable of infecting the surrounding tissues. Possibly the internal conidia may also be instrumental in the perpetuation of the rice blast fungus from one season to the next, so that diseased straw should be excluded from the vicinity of the rice fields to prevent primary infection from this source.

Yabuta (T.) & Hayasi (T.). **Biochemical studies of 'bakanae' fungus of Rice.**—*J. imp. agric. Exp. Sta.*, iii, 3, pp. 365–400, 7 pl., 1940. [Japanese, with English summary.]

This is a fully tabulated account of studies on the biochemical aspects of the 'bakanae' (elongating) disease of rice (*Gibberella fujikuroi*) in Japan, some of the results of which have already been noticed from another source [*R.A.M.*, xix, p. 726]. Fusaric acid produced by the fungus is so toxic that a concentration of 1 in 1,000,000 causes injury. Gibberellin, another product, makes the seedlings grow abnormally tall.

Vlassova (Mme E. V.) & Chariton (E. G.). Роль гриба **Trichoderma lignorum** в регулировании состава микрофлоры почвы. [The influence of the fungus *Trichoderma lignorum* on the composition of soil microflora.]—Научн. зап. по Сахарн. Пром. [*Sci. Notes Sug. Ind.*], Kieff, [Grey Ser.], xvii, 1–2, pp. 125–127, 1940.

Following inoculation of the soil with *Trichoderma lignorum* [*T. viride*: see below, p. 508, and next abstracts] in a field near Kieff, Ukraine, the fungus was found to persist in the soil under all crops of the sugar beet rotation (wheat, beet, lupin, oats, and clover), even as late as one year after inoculation at depths of 10 and 20 cm. The addition of plant remains to the soil stimulated the development of the fungus, which increased from between 0 and 3,000 to 30,000 per gm. of soil. The same increase was observed a fortnight after harvesting wheat or oats, the fungus increasing at the cost of decaying roots. The average numbers of soil bacteria and fungi in fields planted with sugar beet was noticeably reduced following soil inoculation with *T. viride*, but in lupin fields the numbers were increased, more especially at a depth of from 23 to 25 cm. than at from 12 to 14 cm. In clover plots inoculated with *T. viride* the population of soil fungi increased to 213,000 as compared with 110,000 in the uninoculated plot. Cultures of *T. viride* in Petri dishes survived a 20 hours' exposure to bright sunlight. In the field, inoculum of the fungus withstood frost temperatures of −21° in the almost complete absence of snow.

Tatounko (V. D.). Влияние заражения почвы микроорганизмами на превращения органического вещества. [The effect of the infection of soil with micro-organisms on the transformation of organic matter.]—Научн. зап. по Сахарн. Пром. [*Sci. Notes Sug. Ind.*], Kieff, [Grey Ser.], xvii, 1–2, pp. 121–122, 1940.

In laboratory and field experiments conducted during 1938 in the Ukraine it was found that soil inoculated with *Trichoderma lignorum* [*T. viride*: see preceding and next abstract] resulted in an intensified decomposition of organic matter and an increased mineralization of the

nitrogen content of the soil, which is assumed to be mainly responsible for yield increases in crops. Thus, 100 days after the beginning of the experiment, soil inoculated with *T. viride* was found to contain 17·34 mg. of nitrate nitrogen and 22·8 mg. of phosphoric acid per 100 gm. of absolutely dry soil as against 10 and 21·6 mg., respectively, in the uninoculated control. The largest amounts of carbon dioxide were given out by soils inoculated with *T. viride*, followed by those inoculated with *T. viride* plus *Aspergillus niger*, plus *Azotobacter*.

Hino (I.) & Endô (S.). **Trichoderma parasitic on sclerotial fungi.**—*Ann. phytopath. Soc. Japan*, x, 2–3, pp. 231–241, 2 figs., 1940. [Japanese, with English summary.]

Trichoderma viride [see preceding abstracts] has been found to parasitize and often destroy the sclerotia and mycelia of certain pathogenic fungi, e.g., *Corticium rolfsii* [*R.A.M.*, xvii, p. 763], *C. sasakii* [ibid., xviii, p. 617], and *Sclerotinia libertiana* [*S. sclerotiorum*] in Japan. Although *T. viride* is a weak parasite of sweet potatoes and tends to impair the growth of various other crops, its deleterious action on the above-mentioned soil pathogens is considered to outweigh these drawbacks, and hopes are entertained of its application in the biological control of plant diseases [cf. ibid., xx, p. 322].

Szilvinyi (A. V.). **Mikrobiologische Bodenuntersuchungen im Lunzer Gebiet. III. Teil.** [Microbiological soil analyses in the Lunz region. Part III.]—*Zbl. Bakt.*, Abt. 2, ciii, 9–11, pp. 133–189, 47 figs., 1941.

Of the 1,051 strains of soil fungi isolated from 46 soil samples at the Lunz-am-See (Austria) Biological Station from 1930 to 1932, 243 were cultured for a further eight years and specifically identified. The species represented numbered 157, of which 46 were new [and are described with Latin diagnoses] and 30 were new varieties; of the genera represented 36 belonged to the Hyphomycetes and 5 to the Phycomycetes.

Dennis (R. W. G.). **Plants and manganese.**—*Fertil. Feed St. J.*, xxvi, 13, pp. 187–188, 190; 14, pp. 205–207; 15, pp. 219, 221–222; 16, pp. 235, 237, 2 figs., 1941.

This is a useful, fully documented survey of important contributions to the knowledge of the manganese requirements of plants, the history of the subject, and its applications in various countries in the control of manganese deficiency diseases of economic crops.

D'Oliveira (Maria de L.). **Dois virus de Pimento.** [Two Chilli viruses.]—*Agron. lusit.*, ii, 3, pp. 209–223, 1 pl., 1940. [English summary.]

In 1937, two virus diseases of chilli (*Capsicum annuum*) were investigated in Portugal, and found on the basis of inoculation tests, and physical and chemical properties, to be due, respectively, to the tobacco mosaic virus in the Elvas district and the cucumber mosaic virus at Algarve [*R.A.M.*, xvii, pp. 139, 773; xix, p. 61]. In the field the symptoms of the two diseases are liable to confusion, but under controlled conditions tobacco mosaic virus induces slight stunting, a large mosaic pattern on the leaves, accompanied by a certain amount of

rugosity in severe cases, and heavy reductions in yield, while plants infected by cucumber mosaic virus present a rigid, denuded aspect, the leaves being abnormally narrow and pointing downwards, with a profusion of axillary buds; here also the abscission of the floral buds involves a drastic diminution of output, one grower reporting a decrease per plant from 120 to 20 or 25 gm. of the dried product.

Both viruses spread rapidly in the field, the mode of transmission of the tobacco mosaic virus being obscure, while insects are chiefly instrumental in the conveyance of that of cucumber mosaic from diseased to healthy plants. *Solanum nigrum* and *Datura stramonium* were often observed to be infected by tobacco mosaic in chilli plantings, while cucumber mosaic is widespread throughout the country, both on cultivated and wild plants. Seed transmission could not be demonstrated in the case of either virus.

Inoculation experiments with the juice of tobacco mosaic-infected chilli plants gave positive results on White Burley tobacco, *Nicotiana rustica*, *N. texana*, *Hyoscyamus niger*, *D. stramonium*, tomato, *S. nigrum*, and *S. nodiflorum*, and with cucumber mosaic-infected tobacco, *N. glutinosa*, *D. stramonium*, and tomato.

The economic importance of both viruses is regarded as considerable in view of their immense facilities for dispersal, their capacity for persistence in the soil or on alternative hosts, and the virtual impossibility of combating established infections. Control measures can only be of a prophylactic character and should include, in the case of tobacco mosaic, judicious crop rotation and care in the handling of young plants at transplanting and in cultural operations, and in that of cucumber mosaic, the avoidance of conditions promoting insect propagation.

Ramakrishnan (T. S.) & Narasimhalu (I. L.). **A new host—Ricinus communis—for Léveillula taurica (Lév.) Arn. [Oidiopsis taurica (Lév.) Salm.]**—*Curr. Sci.*, x, 4, pp. 211–212, 2 figs., 1941.

The authors record the occurrence of *Oidiopsis* (*Leveillula*) *taurica* on *Ricinus communis* in recent years at Coimbatore, a new host record. The disease is prevalent from November until March. The mildew is chiefly restricted to the lower surface of the leaves, but in advanced stages of severe infection the upper surface is affected as well. The spore measurements averaged 67·3 by 18·7 μ.

Ramakrishnan (T. S.). **Root-rot of Sugarcane.**—*Curr. Sci.*, x, 5, pp. 254–255, 5 figs., 1941.

From the rotted tissues of Co. 413 sugar-cane roots at the Agricultural Research Institute, Coimbatore, the author in 1939 isolated on Quaker oat agar a species of *Pythium* characterized by oogonia each provided with one to four antheridia and measuring 21 to 29·4 (average 26·7) μ in diameter, the cavities of which are largely occupied by spherical, smooth oospores, 18·9 to 25·2 (22·5) μ: the spherical or oval sporangia are produced at the ends of long stalks and give rise to vesicles, each liberating 16 to 20 zoospores; meanwhile a hypha begins to grow through the sporangium and sometimes branches out into a mycelium. The fungus resembles *P. de Baryanum*, the agent of

a sugar-cane root rot in Louisiana [*R.A.M.*, xviii, p. 343], except in its larger oogonia and oospores. The pathogenicity of the organism was established by inoculation experiments on the roots of Co. 413 plants in pots. Le Beau observed in Louisiana that the incidence of root rot was increased by nitrate fertilizers [ibid., xviii, p. 618], and a similar relationship was noted at Coimbatore, where the trouble began after the application of ammonium sulphate to the fields.

KIRYU (T.). **On a method of varietal resistance trials of Sugar Cane to red rot.**—*Ann. phytopath. Soc. Japan*, x, 2–3, pp. 156–170, 4 figs., 1940. [Japanese, with English summary.]

At the Government Sugar Experiment Station, Tainan, Formosa, sugar-cane varieties are tested for their reaction to red rot (*Colletotrichum falcatum*) [*R.A.M.*, xiv, p. 657] by the inoculation of 30 to 40 stalks of each variety with fragments of four-day-old cultures on cane juice agar maintained at 28° C., inserted into apertures 7 mm. in diameter punched in the centre of the internode. Two to three months later, at harvest time, the inoculated stalks are split lengthwise and the extent of the diseased tissue measured.

The resistance of a given variety to the pathogen is computed by the 'theoretical figure' derived from the number of diseased internodes. When the area of the affected portion of the inoculated stalk comprises more than $\frac{2}{3}$ of an internode, it is placed under the sign +++, between $\frac{2}{3}$ and $\frac{1}{3}$ under ++, and below $\frac{1}{3}$ under +. The number of infected internodes in the +++ category is then multiplied by $\frac{3}{3}$ and those in ++ and + by $\frac{2}{3}$ and $\frac{1}{3}$, respectively. The degree of damage (b) is arrived at by dividing the total sum of the three categories of each variety by the number of stalks measured. The ratio (b′), the quotient of the figure of damage of each variety by that of the standard one (P.O.J. 2725), then becomes the theoretical figure for the comparison of resistance of each variety. Where b′ in a given variety is above 1, that variety is less resistant than the standard, whereas a variety in which b′ is below 1 is more resistant than the standard.

The varietal data secured in these tests, which have been in progress since 1936, are tabulated.

KRENNER (J. A.). **Einige mykologische und pflanzenpathologische Angaben aus Ungarn.** [Some mycological and phytopathological data from Hungary.]—*Bot. Közl.*, xxxviii, 1–2, pp. 62–67, 1 fig., 1941. [Hungarian and German.]

Included in this critically annotated list of 47 Hungarian fungi and four bacteria are a number of new records for the country, among which may be mentioned *Bacillus* [*Erwinia*] *dahliae* in living dahlia rhizomes, *Bacterium sorghi* on sorghum [*R.A.M.*, xviii, p. 518], *Pseudomonas mori* on mulberry leaves, *P. pelargonii* on *Pelargonium zonale* foliage [ibid., x, p. 461], *Pleosphaerulina briosiana* [ibid., xvi, p. 279], *Colletotrichum trifolii*, and *Gloeosporium morianum* on lucerne, *Excipulina pinea* [*Crumenula abietina*] on pine (*Pinus sylvestris*) [ibid., vii, p. 209; xx, p. 41], *Septoria linicola* [*Sphaerella linorum*] on flax, *Fusicladium radiosum* [*Venturia populina*] on poplar (*Populus virginiana*) [ibid., xix, p. 387], and *Heterosporium variabile* on spinach.

UNAMUNO (L. M.). **Nueva contribución al estudio de los hongos microscópicos de la flora española.** [A further contribution to the study of the microscopic fungi of the Spanish flora.]—*An. Jard. bot. Madr.*, i (*1940*), pp. 9–58, 13 figs., 1941.

The following are among the 107 species, four of which are new, comprised in this critically annotated list of fungi collected of recent years, largely by the author, in the north of Spain [*R.A.M.*, xx, p. 382]. *Alternaria carolinaeana* n.sp. [with a Latin diagnosis] is characterized by polymorphous, long-beaked, brown to fuligineous conidia, 43 to 150 by 10·7 to 21·5 μ, with 7 to 15 transverse, and 3 to 5 longitudinal septa, borne on simple, cylindrical, straight or slightly arcuate, bi- to triseptate, brown, subfasciculate conidiophores, 43 to 64·5 by 12 to 19 μ, and forms on *Dahlia variabilis* leaves numerous scattered, circular, ellipsoid, subcircular, or angular, brown, later pallid spots 3 to 10 by 2 to 6 mm. in diameter. *Tilletia controversa*, distinguishable from *T. tritici* [*T. caries*] by its more translucent spores with irregularly polygonal edges and lines 2 to 3 μ in length, a new record for Spain, was found on the ovaries of *Agropyron diazii* (= *A. pouzolzii* × *A. sativum*). *Puccinia menthae* was observed on the leaves of *Satureia grandiflora* (a new host for the country) and *Mentha longifolia* [loc. cit.] (in conjunction with *Erysiphe lamprocarpa* on the latter). Two other rusts recorded for the first time in Spain are *P. schroeteri* on the foliage of *Narcissus pseudo-narcissus* [ibid., xiv, p. 366], 1,390 m. above sea-level, and *Uropyxis* [*Cumminsiella*] *sanguinea* on barberry leaves [ibid., xviii, p. 654].

CABALLERO (A.). **Micromicetos del Jardín Botánico de Valencia.** [Micromycetes of the Botanic Garden of Valencia.]—*An. Jard. bot. Madr.*, i (*1940*), pp. 173–200, 15 figs., 1941.

Two new genera, 23 new species, and one new variety [with Latin diagnoses], are included in this critically annotated list of fungi represented in the herbarium of the Botanic Garden, Valencia, Spain, among which may be mentioned *Phyllosticta apicalis* n.sp., forming pallid, later purplish-black, expanding spots on the leaf tips of *Phormium tenax*.

RAYSS (T.). **Nouvelle contribution à l'étude de la mycoflore de Palestine (deuxième partie).** [A new contribution to the study of the mycoflora of Palestine (second part).]—*Palest. J. Bot.*, J Ser., i, pp. 313–335, 3 figs., 1940.

This further instalment of the writer's critically annotated list of Palestinian fungi [*R.A.M.*, xviii, p. 275] comprises 45 species, of which one, *Oidium matthiolae* on living *Matthiola incana* leaves, is regarded as new ad int. [with a Latin diagnosis]. It is characterized by ascendant or erect conidiophores, with few septa, and ovoid or barrel-shaped, smooth, hyaline, bi- to tricatenulate conidia, 30 to 40 by 12 to 16 μ.

WAKEFIELD (E[LSIE] M.) & BISBY (G. R.). **List of Hyphomycetes recorded for Britain.**—*Trans. Brit. mycol. Soc.*, xxv, 1, pp. 49–126, 1941.

This compilation (the third list of British fungi to be completed in

conformity with the recommendations of the Plant Pathology Committee of the British Mycological Society) [cf. *R.A.M.*, xx, p. 179] is preceded by an introduction tracing the history of previous work on the Hyphomycetes. The authors accept E. W. Mason's division of these fungi into two main groups, one with moist or slimy spores and one with dry spores (*Annot. Acct Fungi recd I.M.I.*, List II, Fasc. 3, general part, pp. 68–99, 1937) and they name the former group Gloiosporae and the latter Xerosporae. Each of these two groups is divided into only Amerosporae, Didymosporae, Phragmosporae (including Scolecosporae, as the implied distinction often does not hold); there are also Dictyosporae, Helicosporae, and Staurosporae among the British Xerosporae, and a group of Endosporae placed in the Gloiosporae. The Mycelia Sterilia follow, after which come a few records in excluded, unknown, or uncertain genera. Dermatophytes and conidial stages of powdery mildews are omitted. A total of 1,208 Hyphomycetes is included in the list.

Padwick (G. W.). **The genus Fusarium, V. Fusarium udum Butler, F. vasinfectum Atk. and F. lateritium Nees var. uncinatum Wr.**— *Indian J. agric. Sci.*, x, 6, pp. 863–878, 3 pl. (2 col.), 1940.

In continuation of his studies on the genus *Fusarium* [*R.A.M.*, xx, p. 232], the writer proceeds with the critical discussion of the identity of the various isolates responsible for wilt in cotton, pigeon pea (*Cajanus cajan*), and sunn-hemp (*Crotalaria juncea*), cultures of which were grown for comparison on 2 per cent. potato dextrose agar, Brown's agar with and without starch, and steamed rice, the resultant data being fully tabulated.

The cultures causing typical severe wilt in pigeon pea and *C. juncea* differed from those of *F. vasinfectum*, the agent of the disease in cotton, in three important features, viz., the production of abundant spores in pionnotes, the marked apical hook of the conidia, and the bright orange and yellow of the steamed rice substratum, *F. vasinfectum* forming few or no pionnotes, its conidia being curved but not hooked, and the colour of the rice medium being red (deep purple on the addition of 2 per cent. potassium hydroxide). Several cultures weakly parasitic on *C. juncea* produced conidia considerably exceeding in breadth those of *F. vasinfectum* or the typical pigeon pea and sunn-hemp organisms, and probably referable to the section *Martiella*.

The typical agents of wilt in pigeon pea and *C. juncea*, though clearly distinguishable on a parasitic basis, are identical morphologically and culturally and should both be referred to *F. udum* [ibid., xvii, p. 652], a highly variable species, especially in respect of capacity for chlamydospore formation, spore length, and range of pigmentation. A comparison of a number of isolates of *F. udum* with *F. lateritium* var. *uncinatum* [ibid., xvii, p. 651], as well as with cultures of all varieties and physiologic races of *F. vasinfectum* from the Centraalbureau voor Schimmelcultures, Baarn, Holland, afforded striking confirmation of the previous conclusion that *F. udum* and *F. vasinfectum* are distinct species, besides establishing *F. lateritium* var. *uncinatum* as a synonym of *F. udum*.

The names *F. udum* Butl. var. *cajani* and *F. udum* Butl. var. *crota-*

lariae are proposed for the organisms inducing wilt of pigeon pea and *C. juncea*, respectively.

SHEAR (C. L.). **Mycological notes. V.**—*Mycologia*, xxxiii, 3, pp. 318–332, 1941.

In these critical notes on some of the common North American Pyrenomycetes, the author points out that *Rosellinia aquila* [*R.A.M.*, xvii, p. 601], regarded by various authors as one of the commonest species in the United States, has only been found by him in two collections from that country, all other herbarium specimens labelled *R. aquila* which he examined being *R. corticium* or some other species. The synonymy of the two species is discussed.

DE HAAN (I.). **Gebrekverschijnselen bij Thee veroorzaakt door een tekort aan de belangrijkste minerale voedingsstoffen met uitzondering van kalium.** [Deficiency symptoms on Tea caused by a shortage of the principal mineral nutrient substances, with the exception of potassium.]—*Arch. Theecult. Ned.-Ind.*, xv, 1, pp. 1–32, 3 col. pl., 1 fig., 1 graph, 1941. [English summary.]

A comprehensive, fully tabulated account is given of the writer's observations at the West Java Experiment Station from 1937 to 1940 on the symptoms of tea plants, grown from cuttings in pots filled with quartz sand and deprived severally of the principal nutrient elements, except potassium, the effects of a deficiency of which have already been discussed [*R.A.M.*, xx, p. 363].

Lack of calcium was chiefly apparent in the half-grown leaves, the interveinal spaces along the margins of which developed pale green patches, subsequently shrivelling and turning dark brown, while the growth of the veins was arrested, resulting in an upward curvature of the leaf edges; the mature foliage acquires a brittle texture.

The fully-developed leaves of plants deprived of magnesium assumed a pale yellow tinge, except for the areas immediately adjacent to the veins, and showed a tendency to convex bulging. A less characteristic feature was the appearance of brown, necrotic patches at the vein-endings near the leaf margins. This condition has been observed in tea plantations along the east coast of Sumatra, in two of which the magnesium content of the leaf ash was 3·04 and 2·46 per cent., respectively, compared with 9·30 per cent. in that of samples from normal soil; in the sand cultures with no magnesium the corresponding figure was 3·3 per cent.

Apart from a somewhat unusually dark coloration of the leaves, no symptoms of phosphorus deficiency developed until after pruning in 1939, when a dull, dark- to bluish-green tinge became noticeable, while in some cases the tips shrivelled and turned dark brown; at the end of 1940 reddish-brown spots appeared along the margins, presumably representing an advanced stage of the shortage. The production of a new flush of leaves after pruning was much diminished. A bluish-green tint has sometimes been observed on the foliage of bushes recently subjected to low pruning in plantations on phosphorus-deficient soils.

Lack of nitrogen was expressed by the production of small, pale yellow

leaves, pointing stiffly outwards, or in extreme cases by the complete cessation of all further development. These symptoms may often be seen in plantations on poor soils.

Symptoms of sulphur deficiency [ibid., xii, p. 537] have not been noticed in Java or Sumatra.

Thompson (A.). **Branch canker of Tea.**—*Malay. agric. J.*, xxix, 4, pp. 152–154, 1 pl., 1941.

Tea bushes in the Cameron Highlands, Malaya, growing on an area undergoing pruning for the second time, were found to show cankers, evidently not of recent origin, on the upper surface of horizontal branches. The lesions ranged from 2 to 6 in. long by ½ to 1½ in. wide; no fungus was seen on any bush examined, and the only one which developed in culture from the margins of typical cankers was a species of *Diplodia*.

The location of the cankers and the fact that the bushes were growing in a situation exposed to the sun during the heat of the day are considered to indicate that the condition was due to sun scorch at pruning. The most satisfactory method of control would probably be the provision of overhead shade.

Van Schreven (D. A.). **Control of Tobacco mosaic by means of extracts of tanning substances.**—*Natuurwet. Tijdschr. Ned. Ind.*, ci, 4, pp. 113–114, 1941.

At the Klaten (Central Java) Tobacco Experiment Station the writer investigated the action of various kinds of tannin on the tobacco mosaic virus [*R.A.M.*, xv, p. 178]. The hands of workers moistened with undiluted filtered juice of mosaic-diseased leaves were completely disinfected by washing in a 1·5 or 8 per cent. tannic acid solution extracted from galls on *Rhus semilata*, while a commercial tanning substance of unknown origin, in the form of a solid aggregate, produced the same effect at a strength of 0·5 per cent. A 15 per cent. tanning extract from the bark of *Acacia decurrens*, when added to juice from mosaic-diseased tobacco in equal volumes, inactivated the virus within half a minute, as demonstrated by rubbing the suspension on young tobacco leaves, while an aqueous extract of mangrove [? *Rhizophora*] bark, which also contains tannin, acted similarly. It is thought probable that all tannin-containing plants yield extracts capable of inactivating the tobacco mosaic virus, in which case its loss of virulence on treatment with *Phytolacca decandra* extract [ibid., v, p. 377] would be explicable by the tannin content of the foliage and fruits. Soil disinfection against the virus may also be carried out with a tannin extract solution. The addition of a standard fungicide to tannin solutions intended for keeping is requisite to prevent fungal deterioration. Tannin solutions are likewise effective against white mosaic, distorting mosaic [ibid., xix, p. 241], Holmes's masked strain, mild mosaic, ring spot necrosis, tobacco ring mosaic, and mosaic VI B [ibid., xviii, p. 207]. The tannin method of virus inactivation is equally effective with the trisodium phosphate treatment recommended by van der Weij [ibid., xx, p. 279], to which it is regarded as preferable owing to the absence of any irritant action on the skin.

Valleau (W. D.) & Diachun (S.). **Virus distribution in mosaic-resistant Tobacco and its relation to pattern development in susceptible varieties.**—*J. agric. Res.*, lxii, 4, pp. 241–247, 7 figs., 1941.

The distribution of the 'pure white' strain of the tobacco mosaic virus [*R.A.M.*, xviii, p. 823] within the leaves of resistant tobacco plants (hybrids of Ambalema × Burley tobacco) was found in Kentucky to be quite accurately indicated by the pattern of chlorotic spots to which the virus appeared to be almost entirely confined. The progress of the virus within the plant is assumed to take place by a long-distance movement of virus particles or aggregates of particles from points of inoculation and multiplication followed by slow cell-to-cell movement in the immediate vicinity of the point of lodgement of the virus particle. In resistant plants the multiplication of virus at the point of inoculation is slow and the virus is released only slowly or not at all for long-distance spread. It is suggested that the difference between the so-called slow- and rapidly-moving virus strains lies in the rate of multiplication of the virus rather than in rate of actual movement. The pattern development in susceptible tobacco plants may be deduced from observations on the distribution of the virus in resistant plants. It is stated that many of the different symptom complexes in susceptible tobacco caused by the different strains of the tobacco mosaic virus, such as mottled mosaic, ring mosaic, speckled mosaic, and others, can be duplicated in resistant tobacco by the use of a single virus strain on plants of different degrees of resistance.

Valleau (W. D.) & Diachun (S.). **Virus distribution in the leaves of mosaic-susceptible Tobacco plants inoculated at topping time.**—*J. agric. Res.*, lxii, 4, pp. 249–254, 2 figs., 1941.

In field and greenhouse experiments in Kentucky it was found that the advance of various strains of tobacco mosaic virus [see preceding abstract] inoculated into highly susceptible Burley tobacco plants at topping time was extremely slow if the leaves had attained almost full size. The top leaves of plants not yet in bloom were more rapidly invaded, but they matured before the infection had time to become general and the virus remained localized in scattered spots, which slowly increased in size. Uninoculated leaves of inoculated greenhouse plants were virus-free at the end of a month; at the end of two months only the midribs and laterals of some leaves were invaded but not the blade tissue. It is concluded from these results that infection at topping time can have little or no influence on the quality of the cured leaf if the plants are topped in the full bloom stage; if they are topped early, when the flower buds are just beginning to show, some upper leaves may be affected.

Spencer (E. L.). **Inhibition of increase and activity of Tobacco-mosaic virus under nitrogen-deficient conditions.**—*Plant Physiol.*, xvi, 2, pp. 227–239, 1 graph, 1941.

In experiments made to ascertain how tobacco mosaic virus is affected in a plant deficient in nitrogen, Turkish tobacco seedlings grown in sand cultures and given a complete nutrient solution (nitrogen level, 200 p.p.m.) were inoculated with tobacco mosaic virus, the plants being divided ten days later into two groups, of which one continued

to receive the complete solution, while the other received a nutrient solution deficient only in nitrogen. Representative plants were removed from each group at intervals of four days, and the expressed juice was assayed for relative virus activity, total protein, and virus protein.

In the nitrogen-deficient plants the virus-protein content and the soluble plant-protein content remained almost constant, whereas in the plants that received nitrogen each increased more than 5 times in 16 days. No decrease was noted in the yield of virus protein in the nitrogen-deficient plants, but its biological activity showed over 40 per cent. reduction.

The evidence showed that in the nitrogen-deficient plants the virus protein acted as a foreign protein, the virus apparently being unaffected by the normal proteolytic processes of the host. Plants with severe nitrogen deficiency were unable to use in the synthesis of normal proteins any nitrogen previously utilized by the virus. The virus, however, was unable to utilize any nitrogen in the proteins normally present in a nitrogen-deficient plant, for in the absence of an external supply of nitrogen no further virus multiplication was detected.

Nakata (K.) & Takimoto (S.). **A white strain of common Tobacco mosaic.** - *Ann. phytopath. Soc. Japan*, x, 2 3, pp. 242 253, 1 col. pl., 14 figs., 1940. [Japanese, with English summary.]

A white mosaic of tobacco in the Hukuoka district of Japan, infectious to most Solanaceae and causing severe stunting of *Petunia*, is regarded as distinct from E. M. Johnson's white mosaic [*R.A.M.*, x, p. 60] and may represent a strain of the common tobacco mosaic virus (*Nicotiana* virus 1) capable of inducing a white mottling on tobacco. *N. sylvestris* also developed mottling on inoculation with the white mosaic virus.

Bawden (F. C.) & Kassanis (B.). **Some properties of Tobacco etch viruses.** – *Ann. appl. Biol.*, xxviii, 2, pp. 107 118, 1 pl., 1941.

In studies on the properties of the tobacco etch viruses [*R.A.M.*, xix, pp. 241, 562] it was demonstrated that plants affected by severe or mild etch contain both intranuclear and cytoplasmic inclusions. The nuclei of plants with mild etch show fewer and larger crystals than those of plants with severe etch. Plants infected as seedlings with the severe etch virus (referred to as S.E.V.) develop malformed leaves, in which the cytoplasmic inclusions crystallize and give rise to bi refringent needles. Plants affected by mild etch (M.E.V.) are thereby protected against infection with severe etch. That these two viruses are serologically related is shown by the fact that antisera prepared against either react with severe etch virus.

Though not serologically related to potato virus Y or *Hyoscyamus* virus 3, severe etch virus has similar properties *in vitro* and is transmitted in the same manner. The interactions of these three viruses in the plant suggest some relationship between them. Plants infected with potato virus Y or *Hyoscyamus* virus 3 are not protected against severe etch, and those infected with virus Y are susceptible to *Hyoscyamus* virus 3. Plants infected with severe etch, on the other hand, are protected against the other viruses, and those infected with *Hyo-*

scyamus virus 3 are protected against potato virus Y. Severe etch can suppress these two viruses when healthy plants are infected with a mixed inoculum, and can supplant them in tissues in which they are already established. Similarly, *Hyoscyamus* virus 3 can suppress and supplant potato virus Y.

Weber (G. F.) & Kelbert (G. A.). **Seasonal occurrence of Tomato diseases in Florida.**—*Bull. Fla agric. Exp. Sta.* 345, 26 pp., 21 figs., 1 map, 1940.

Popular descriptions are given of some well-known diseases affecting the Florida tomato crop, with special reference to seasonal and environmental factors in relation to their development and control.

Brien (R. M.). **'Foot-rot' of Tomatoes caused by Phytophthora cryptogea.**—*N.Z. J. Sci. Tech.*, A, xxii, 4, pp. 232–236, 2 figs., 1940.

The foot rot of tomatoes caused by *Phytophthora cryptogea* [*R.A.M.*, xix, p. 70] was observed for the first time in New Zealand in 1938, its pathogenicity being established by inoculation experiments. Non-papillate sporangia measuring 24 to 50 by 16 to 31 (average 37 by 24) μ were produced only on infected tomato roots and stems held in Petri dishes containing moistened filter pads for three days at 23° C.

Tompkins (C. M.) & Tucker (C. M.). **Buckeye of Tomato in California.**—*J. agric. Res.*, lxii, 8, pp. 467–474, 2 figs., 1941.

Buckeye rot of green tomato fruits has consistently been ascribed to *Phytophthora parasitica* by investigators in various countries, though Bewley reported that in England the rot may also be caused by *P. cryptogea* [cf. preceding abstract]. Isolations from 300 tomato fruits in 1938 and 1939 in California yielded only *P. drechsleri* [*R.A.M.*, xvi, p. 793] and *P. capsici* in the former year and *P. capsici* alone in the latter. In inoculation tests both species proved pathogenic to unwounded fruits, the incubation period being 11 days for *P. drechsleri* and 7 for *P. capsici*. The disease is stated to be prevalent in several interior valleys of central California. It is favoured by high temperatures and humidity and above all by contact of the fruit with moist soil or with irrigation water. In inoculation tests with the three species, Yellow Crookneck and Zucchini pumpkin and *Cucurbita pepo* var. *condensa* fruits were only infected by *P. capsici* and *P. parasitica*, bell pepper (*Capsicum annuum* var. *grossum*), Newton Pippin apple, and cucumber only by *P. capsici* [ibid., xx, p. 317]. Purple Top White Globe turnip roots by *P. drechsleri* and *P. parasitica*, and carrot roots by *P. capsici* and *P. drechsleri*.

Fawcett (G. L.). **La peste negra de los Tomates y la corcova del Tabaco.** [The 'black pest' of Tomatoes and 'corcova' of Tobacco.] *Rev. industr. agríc. Tucumán*, xxx, 10–12, pp. 221–226, 3 figs., 1940.

In 1937, at the Tucumán (Argentine) Agricultural Experiment Station, the writer successfully transmitted the virus of 'black pest' (apparently identical with spotted wilt) of tomatoes from diseased to healthy tomato plants by means of *Frankliniella paucispinosa*, and

from infected tomato to sound tomato and tobacco plants by rubbing the leaves with an extract of juice from affected foliage, the latter method having been employed as early as 1933, when the first indication that 'black pest' and 'corcova' [hunchback] of tobacco [*R.A.M.*, xix, p. 8; xx, p. 105] were due to the same virus was obtained. On this occasion, 9 out of 20 tobacco plants inoculated with the 'black pest' virus from tomatoes contracted the typical symptoms of 'corcova', while between 1933 and 1937, 5 out of 19 plants similarly treated developed 'corcova'. In 1940, all the four tobacco plants inoculated with 'black pest' displayed the 'corcova' symptoms, while conversely, two tomatoes treated with juice from 'corcova' tobacco plants rapidly developed 'black pest'. In 1937 *F. paucispinosa* conveyed 'corcova' from tobacco to tomato. Both diseases are likewise intertransmissible by grafting.

The 'black pest' virus has been inactivated in some tests at 38° C. and in others at 40°.

Attention is drawn to a minor difference between the 'kromnek' disease (spotted wilt) of tobacco in South Africa [ibid., xiii, p. 129] and 'corcova' in the Argentine, consisting in the absence in the latter of the discontinuous, vitreous, later dark lines on the leaves characteristic of the former. Moreover, tomatoes affected by 'black pest' in the Argentine do not show the yellow mottling associated with the disease elsewhere.

The 'vira-cabeça' [top necrosis] of potatoes in Brazil [ibid., xviii, p. 338] appears to be identical with 'corcova'.

CHAMBERLAIN (E. E.). **Severe-streak of Tomatoes. A composite virus disease occurring in New Zealand.**—*N. Z. J. Sci. Tech.*, A, xxii, 4, pp. 181–186, 3 figs., 1940.

The tomato disease originally described under the name of severe streak [cf. *R.A.M.*, xix, p. 372] has now been found to be caused by a combination of tobacco mosaic and a necrotic virus [see next abstract]. After the first appearance of the disease in 1933, it remained in abeyance until 1938, when nearly 40 per cent. of a dwarf tomato crop covering 4½ acres was infected by the double virus. Tobacco mosaic was also present alone to the extent of over 30 per cent., but the necrotic virus was only observed in conjunction with tobacco mosaic. In the 1939–40 season the two diseases were again present in the same garden, 25 per cent. of the crop being affected by tobacco mosaic but only a few plants showing the mixed virus.

Severe streak is readily communicable to tomato and tobacco by leaf-rubbing, every one of the plants of both hosts (Sutton's Best of All, Australian Dwarf, and Kondine tomatoes and Warne and Hickory Pryor tobacco) contracting the disease. Tobacco leaves develop brown, necrotic areas, $\frac{1}{16}$ in. or more in diameter, or ring spots consisting of a brown or pale, necrotic circle surrounding a small, necrotic spot. Secondary symptoms on older leaves assume the form of dark brown, necrotic lesions, often occurring as irregular circles or bands along the veins, while the young foliage shows severe interveinal necrosis, sometimes extending over the whole leaf, vein-clearing, later replaced by

mosaic mottling, and short, light brown, necrotic, superficial streaks; the diseased plants are much stunted.

Only the necrotic virus was recoverable from tree tomato (*Cyphomandra betacea*) plants inoculated with severe streak, though the plants developed mosaic mottling of the foliage, and severe streak symptoms were reproduced on tomato and tobacco with a combination of this virus with tobacco mosaic. It is thus apparent that the disease is due to a combination of the two viruses. The standard control measures for tobacco mosaic should also be effective against the necrotic virus, which is not in itself of economic importance.

CHAMBERLAIN (E. E.). **Tomato necrosis. A component of severe-streak of Tomatoes.**—*N.Z. J. Sci. Tech.*, A, xxii, 4, pp. 186–197, 5 figs., 1940.

The necrotic virus component of severe streak of tomato, separable from that of tobacco mosaic by passage through *Cyphomandra betacea* [see preceding abstract], produces on tomato leaves subcircular spots, $\frac{1}{16}$ in. in diameter, dark brown with paler centres. A few days later dark brown, necrotic bands develop along the veins, imparting a reticulate appearance, or small, dark, necrotic spots appear scattered over the leaf surface. In severe cases the lower and intermediate leaves tend to curl downwards and the plants are stunted.

The virus was transmitted by leaf-rubbing from tomato and tobacco to both hosts, from *C. betacea* to tobacco, from tomato and tobacco to *C. betacea*, from *C. betacea* and tobacco to *Datura stramonium* and *Physalis peruviana*, from tobacco to eggplant, *Nicotiana rustica*, and *N. glauca*, from tomato to Iron Duke potato and chilli, and from tobacco to *N. glutinosa*, and was transferred back from *C. betacea* to tomato and tobacco and from the other plants listed to tobacco. The symptoms on each of the artificially inoculated hosts are described.

The longevity of the virus *in vitro* exceeds 17 weeks; its dilution end-point lies between 1 in 500,000 and 1 in 1,000,000, and its thermal death point between 64° and 66° C. The virus does not agree with potato virus X, a common agent, in conjunction with tobacco mosaic, of tomato streak in other countries, or with any of the viruses of Solanaceous plants listed by K. M. Smith [*R.A.M.*, xvii, p. 52], and is therefore regarded as new.

CAMPBELL (W. A.) & DAVIDSON (R. W.). **Cankers and decay of Yellow Birch associated with Fomes igniarius var. laevigatus.**—*J. For.*, xxxix, 6, pp. 559–560, 1 fig., 1941.

Fomes igniarius var. *laevigatus* [*R.A.M.*, xv, p. 620] has been found associated with canker production and extensive decay of the trunks of yellow birches (*Betula lutea*) in the Adirondacks, Vermont, and Pennsylvania, the diameter of the affected trees usually ranging from 18 to 30 in. at breast height. On large trees the cankers formed depressions of appreciable extent to which the bark adhered firmly. The sterile mycelium impregnating the face of the canker was hard, black, superficially much cracked, brown and softer below. This brittle layer of bark and fungus varied between $\frac{1}{4}$ and $\frac{1}{2}$ in. in thickness and was closely appressed to the underlying wood. The number of cankers per

tree ranged from one to seven. In the present observations the thin, flat, brown, resupinate sporophores developed chiefly round the cankers on dead standing trees. Only one sporophore was detected by the writers on a living tree, but P. Spaulding and J. R. Hansbrough have a number of records of the occurrence of fruit bodies on living yellow birches. Eight yellow and eight black birches (*B. lenta*), 4 to 6 in. in diameter at breast height, were inoculated in August, 1936, with sterilized rye cultures of *F. igniarius* var. *laevigatus*, the average extent of the resultant decay in June, 1939, being 29 in. The presence of the fungus in the sapwood points to its potential capacity for vigorous attacks on living trees. It was reisolated from two of the seven trees in which the rot developed.

De Almeida (F. J.). **Safra e contra-safra na Oliveira.** [Production and counter-production in the Olive tree.]—[*Publ.*] *Minist. Agric., Lisboa*, Sér. Invest., 7, 154 pp., 44 figs., 6 graphs, 1940.

Included in this survey of the factors affecting olive production in Portugal is a very brief section on diseases as one of the causes of poor harvests, the organisms listed being *Rosellinia necatrix*, *Bacterium* [*Pseudomonas*] *savastanoi* [R.A.M., xx, p. 451], and *Antennaria elaeophila*, which diminishes photosynthetic activity by preventing the access of air and light to the foliar parenchyma, *Cycloconium oleaginum* [ibid., xix, p. 582], and *Gloeosporium olivarum* [ibid., xv, p. 521].

Leaf scorch of Douglas Fir.—*Gdnrs' Chron.*, Ser. 3, cx, 2845, p. 2, 1941.

Douglas fir trees [*Pseudotsuga taxifolia*] in England appear likely to suffer serious trouble from infection by *Rhabdocline pseudotsugae* [*R.A.M.*, xi, p. 82; xix, p. 248]. The disease is most dangerous in this country on the Blue Douglas and Intermediate or Fraser River varieties, while the Oregon variety sometimes shows slight burning. Trees of all ages are attacked, but nursery stock and trees up to 30 years of age suffer most. Individual trees have been observed to remain healthy when growing in affected nurseries, and these should be kept to form the final crop, and to produce seeds. All infected stock should be cut out, and the young stock in the nursery should be sprayed with Bordeaux mixture or lime-sulphur [ibid., xviii, p. 3].

Darlington (H. T.) & Culver (L. B.). **Keys to the species of Ribes occurring in the Great Lakes region.**—*Circ. Bull. Mich. agric. Exp. Sta.* 170, 23 pp., 12 figs., 1939.

Two keys are provided to the species of *Ribes* occurring in the Great Lakes region, one prepared on the characters noticeable during the dormant season and the other on those developing in the course of growth, and briefly designated 'winter' and 'summer' keys, respectively. One of the main objects of the classification is to assist phytopathologists in the determination of specific susceptibility to white pine blister rust (*Cronartium ribicola*) [*R.A.M.*, xx, p. 435].

Despeissis (J. L.). **A preliminary investigation of blue stain in 'kauvula' timber.**—*Agric. J. Fiji*, xii, 2, pp. 37–40, 1941.

Continuing his investigations into blue stain (associated under

Australian conditions with *Ceratostomella* spp.) of 'kauvula' (*Endospermum* spp.) timber in Fiji [*R.A.M.*, xx, p. 285], the author states that the dangerous period is while seasoning is in progress. Protection is afforded by rapid drying under conditions not favourable to fungal growth, or by dipping in borax solution [loc. cit.]. By controlling the temperature during kiln seasoning, it should be possible to render the borax treatment unnecessary.

Tests showed that a temperature of 130° F. at 100 per cent. relative humidity, if maintained for several hours, effectively sterilizes infected timber up to 4 by 4 in. in size, while 150° at 100 per cent. relative humidity for 9 hours effectively sterilizes timber up to 9 by 9 in. Air-dry timber is immune from attack by blue stain, and if infection is to be obviated, a temperature of 130° or over must be maintained until the moisture content falls below 20 per cent.

The author's investigations show three alternative methods of improving on the performance of the original kiln. The first is to improve the ventilation and maintain the temperature continuously above 130°; this should halve the seasoning period, and remove all danger of infection. It would, however, prove unduly expensive. The second, and most economical method at present, would be to continue the borax dip, and retain the kiln and the present working schedule. This gives a reasonable degree of freedom from infection and involves a minimum of additional expense. The third method remains to be tested. This is, to dry the timber first to below a moisture content of 20 per cent., thus destroying the fungi, and afterwards to steam it for the purpose of removing the odour. This method offers the possibility of saving the expense of the borax and of the labour used in dipping.

Moesz (G. v.). **Die Pilze der Bergwerke und Höhlen in Ungarn.** [Mine and cave fungi in Hungary.]—*Bot. Közl.*, xxxviii, 1–2, pp. 4–11, 1941. [Hungarian, with German summary.]

Of the fungi collected in mines, caves, and cellars in Hungary, totalling 79, *Stereum hirsutum*, *Leptoporus fodinarum* (*Poria vaporaria* Auct. non Fries), *L. rufoflavus* (B. & C.) Pilát (syn. *L. braunii*), *Physisporinus vitraeus* (*Poria undata*), *Trametes* (*Lenzites*) *betulina*, and *T.* (*Polystictus*) *versicolor* were among the most common in the first-named habitat, while other species represented were *Coniophora cerebella* [*C. puteana*], *Merulius lacrymans*, *Poria vaillantii*, *T. quercina*, *Ganoderma lucidum*, *L. abietinus*, *Polyporus* [*Fomes*] *annosus*, *Armillaria mellea*, *Collybia velutipes*, *Lentinus lepideus*, and *Paxillus panuoides*.

Liese (J.) & Schubert (R.). **Beiträge zum Osmose-Verfahren.** [Contributions to the osmosis process.]—*Holz Roh- u. Werkstoff*, iv, 3, pp. 93–101, 4 figs., 10 graphs, 1941.

A tabulated account is given of the writers' laboratory and field experiments in 1939–40 at the Eberswalde (Germany) Forestry Institute to settle certain outstanding points in connexion with the osmotic method of timber preservation [*R.A.M.*, xix, p. 181]. It was ascertained in laboratory tests with an arsenic-containing U salt of the composition thanalith U, basilite UA, and osmol UA (paste 1 : 0·5) that the depth of penetration of sap-fresh pine sapwood depends on

the alignment of the xylem fibres, being much more extensive in the direction parallel with the fibres than radially, whilst penetration in the tangential direction was still less. With air-dried moistened sapwood the results were similar, but the penetration was not as great in the parallel and tangential directions, though greater in the radial. The addition of 5 per cent. colloid facilitated penetration at the beginning but checked it later on. In field experiments on sap-fresh pine, spruce, and beech (spruce wood felled at the end of December was shown in preliminary tests in 1934–5 to remain in a sap-fresh condition until the beginning of May), the three woods responded to penetration in the order named, the depth of infiltration (computed by means of a zircon oxychloride reagent) of the above-mentioned U salt into pine, spruce, and beech being 22, 20, and 19 mm., respectively, while the corresponding figures for a mixture of the foregoing and sodium fluoride (1 : 1) were 28, 25, and 23 mm., respectively, and for sodium fluoride alone, 30, 26, and 24 mm., respectively: the colloid adjuvant was incorporated with all the mixtures. The depth of infiltration of the protective salts depends on the sodium fluoride content of the mixture. In tests on air-dry pine and spruce wood fashioned into beams ($12 \times 14 \times 80$ cm.), planks ($5 \times 10 \times 150$ cm.), and boards ($2{\cdot}5 \times 80$ cm.) the following results were obtained. The pine boards (mostly sapwood) impregnated with the U salt mixture (without colloid) were found on inspection after four months to be completely permeated, whereas planks of the same wood (largely heartwood) were only partially infiltrated, the protective coating extending on all sides for a distance of 10 to 25 mm. but embracing the heartwood only down to 15 mm. Pine beams were similarly impregnated to a depth of 25 mm. of the sapwood, but only 5 to 10 mm. of the heartwood. Comparable data were secured in the spruce tests, the boards being for the most part fully infiltrated, while the depths of penetration into planks and beams were 6 to 25 and 10 to 15 mm., respectively.

A comparison of the osmosis values with those reported by workers in two other institutions in connexion with the application of an arsenical U salt to pine wood for the control of *Lenzites abietina* and *Coniophora cerebella* [*C. puteana*] by the Boucherie process [ibid., xix, p. 58], which gives depths of infiltration ranging from 33 to 70 mm., demonstrates the superiority of the latter method from this point of view. Osmosis, however, possesses certain advantages, notably simplicity, independence of a copious water supply, and applicability to felled wood *in situ*, which eminently fit it for silvicultural uses, more especially in the tropics.

GREEN (D. E.). **Hygiene in the war-time vegetable garden. VI, VII, & VIII.**—*J. R. hort. Soc.*, lxvi, 6, pp. 210–214, 4 figs. (between pp. xlvi and xlvii); 7, pp. 251–255, 3 figs.; 8, pp. 290–294, 4 figs., 1941.

Continuing his earlier papers in this series [*R.A.M.*, xx, p. 324] the author gives short popular notes on the symptoms and control of the chief fungous, virus, and non-parasitic diseases of tomatoes and vegetables in England.

Larson (R. H.) & Walker (J. C.). **Ring necrosis of Cabbage.**—*J. agric. Res.*, lxii, 8, pp. 475–491, 12 figs., 1941.

A virus disease of cabbage observed in 1937 at Madison, Wisconsin, is described under the name of ring necrosis. It resembles in several respects the viruses of black ring [*R.A.M.*, xvii, p. 151] and ring spot [ibid., xiv, p. 669] of cabbage, but it is distinguished from them by physical properties, host range, and symptoms on the common hosts. One of the major differences between ring necrosis and black ring is the masking of the former at 13° to 19° C. On cabbage growing at 22° to 25° no symptoms appear on inoculated leaves, but 17 to 21 days after inoculation small, yellow lesions appear on the fourth or fifth unfolded leaf. The lesions increase in size and number and become necrotic in the centre; later necrotic concentric rings develop, giving a bull's-eye spot in which the dead tissue is brown or blue black. The tissue between the lesions becomes dry and brittle and the leaves drop prematurely. Necrosis may also develop on or along the veins. The ring necrosis virus infected all the 25 species and subspecies of crucifers tested and also sugar beet, Swiss chard (*Beta vulgaris* var. *cicla*), spinach, tobacco, *Nicotiana glutinosa*, *N. langsdorffii*, *N. rustica*, *N. repanda*, *Petunia*, *Zinnia*, and *Calendula*. It was transmitted by mechanical inoculation and through the aphids *Myzus persicae* and *Brevicoryne brassicae*. *In vitro* the virus remained infective after 36 but not 48 hours' ageing at 20° to 22° C., it was inactivated by ten minutes' heating at 50° but not at 48°, and tolerated dilution to 1 in 500 but not to 1 in 600.

Stubbs (L. L.). **Some diseases of Cabbages and Cauliflowers.**—*J. Dep. Agric. Vict.*, xxxix, 5, pp. 208–212, 5 figs., 1941.

Short, popular notes are given on the symptoms, causes, and control of the chief diseases of cabbages and cauliflowers in Victoria. Against blackleg (*Phoma lingam*) it is important to adopt preventive measures [*R.A.M.*, xi, p. 489] comprising the use of clean seed from healthy plants, clean soil for the seed-bed, rotation with non-cruciferous crops, furrow irrigation, and seed disinfection with mercuric chloride (30 minutes in 1 in 1,000 solution). In America, hot water treatment (122° F. for 15 to 30 minutes) is claimed to have given complete disinfection, but germination may be impaired.

Against club root (*Plasmodiophora brassicae*) [ibid., xix, p. 356] control methods are very difficult. The growing of cruciferous crops in infected soil should, if possible, be abandoned. If this is impracticable, a rotation of at least four years should be practised. Heavy liming (one to two tons per acre of agricultural lime, applied several months before planting, are tentatively recommended) will suppress infection, but, if potatoes are included in the rotation, will favour scab (*Actinomyces scabies*). In the United States, J. C. Walker (*Fmrs' Bull. U.S. Dep. Agric.* 1439, 1938) has recommended keeping the soil uniformly moist during the growing period to enable the lime to neutralize acidity round the roots. In England and New Zealand treatment with mercuric chloride is recommended [*R.A.M.*, xiv, pp. 2, 278].

Cauliflower whiptail is widely prevalent on acid soils in Victoria, where successful control has followed liming [ibid., xiii, p. 344].

Leach (L. D.). **Root-rot diseases of Sugar Beets in California.**—*Sug. Bull., N.O.*, v, 2, pp. 56–57, 1941. [Abs. in *Sugar* (formerly *Facts ab. Sug.*), xxxvi, 7, p. 43, 1941.]

The most important root rots of sugar beet in California are southern *Sclerotium* rot [*S. rolfsii*: *R.A.M.*, xviii, p. 76], dry rot canker (*Rhizoctonia* [*Corticium*] *solani*) [ibid., xx, p. 391], charcoal rot, and wet (*Phytophthora*) root rot, especially the two first-named. The soil population of *S. rolfsii* can be reduced to a safe level in two to four years by rotation with cereals or winter crops, such as peas, spinach, or lettuce, whereas beans [*Phaseolus vulgaris*], both on account of their susceptibility to the pathogen and their cultivation during the summer at the high temperatures favouring its growth, contribute to the maintenance or increase of the fungus. Infection may be reduced by one-half by the application of a commercial fertilizer containing 100 lb. nitrogen [per acre].

The control of *C. solani* is complicated by the existence of physiologic races of the fungus attacking a variety of crops. Beans and potatoes at any rate should be excluded from the rotation with sugar beets.

Свекловодство. I. Биология, генетика и селекция Сахарной Свеклы [Sugar Beet growing. I. Biology, genetics, and selection of Sugar Beet.]—918 pp., 306 figs., 12 diags., 34 graphs, 11 maps, Kieff, Госуд. Издат. колх.-совх. Литер. У.С.С.Р. [State Publ. Off. Lit. collect. co-op. Farming Ukrainian S.S.R.], 1940.

This volume on the biology, genetics, and selection of sugar beet issued by the Pan-Soviet Scientific Research Institute for Sugar Industry (VNIS) contains one chapter on the selection of sugar beet for resistance to fungous diseases by V. N. Shevtchenko (pp. 787–794), in which Russian and foreign work on the subject is critically reviewed.

Omeltchouk (A. V.). Влияние заражения почвы грибом **Trichoderma lignorum** на урожай Сахарной Свеклы и изменение почвенных процессов. [The effect of the infection of soil with the fungus *Trichoderma lignorum* on the yield of Sugar Beet and changes in soil processes.]—Научн. зап. по Сахарн. Пром. [*Sci. Notes Sug. Ind.*], Kieff, [Grey Ser.], xvii, 1–2, pp. 119–121, 1940.

The results of field experiments conducted by the VNIS [Pan-Soviet Scientific Research Institute for Sugar Industry] showed that inoculation of the soil in spring and autumn with *Trichoderma lignorum* [*T. viride*: *R.A.M.*, xix, p. 381; xx, p. 322; and above, pp. 491, 492], *Aspergillus niger*, and *Azotobacter* led to an increase in the water content of the soil, which could be utilized by the sugar beet during the dry periods of the year. Moreover, it facilitated the assimilation of nutritive elements from the soil and increased the yield, the maximum increases resulting from the inoculation of soil with *T. viride* and *A. niger*, with or without *Azotobacter*.

Townsend (G. R.). **Diseases of Beans in southern Florida.**—*Bull. Fla agric. Exp. Sta.* 336, 60 pp., 11 figs., 2 graphs, 1939. [Received August, 1941.]

Popular descriptions are given of a number of well-known bean

[*Phaseolus vulgaris*] diseases in southern Florida, with discussions of the factors involved in their occurrence and directions for control by cultural practices and direct fungicidal treatments.

Bremer (A.). **Beobachtungen quantitativer Art über das Auftreten von Schäden an Gemüsepflanzen auf dem Versuchsfelde der Zweigstelle Aschersleben der Biologischen Reichsanstalt für Land- und Forstwirtschaft während der Jahre 1929 bis 1935. 3. Mitteilung.** [Observations of a quantitative character on the occurrence of injuries to vegetable plants on the experimental field of the Aschersleben branch of the Biological Institute for Agriculture and Forestry during the years 1929 to 1935. Note 3.]—*Z. PflKrankh.*, l, 12, pp. 577–595, 1 fig., 3 graphs, 1940.

Some 40 per cent. of a pea seed sample tested in the laboratory at the Aschersleben [Saxony] branch of the Biological Institute in 1935, were found to be infected by *Ascochyta pisi* [*R.A.M.*, xix, p. 510], giving a proportion of emergence ranging from 23 to 62 per cent. compared with 84 to 100 per cent. (with the exception of one July-sown batch which gave 48 per cent. only) for healthy material. As was to be expected, emergence in both the healthy and diseased samples was best in April and May, falling off in the summer with rising temperatures and declining rainfall. In 1934, out of 102 samples tested the number with no pod infection was 78, those with pod infections of 1 to 10 per cent. numbered 20, and of 11 to 20, 21 to 30, and 31 to 40 per cent., 2, 1, and 1, respectively; in 1935, out of 226 samples tested, 135 showed no pod infection, 51 showed 1 to 10 per cent., while there were 13, 14, 3, 2, 6, and 2 with 11 to 20, 21 to 30, 31 to 40, 41 to 50, 51 to 75, and 76 to 100 per cent., respectively. The total numbers of pods involved in 1934 and 1935 were 6,661 and 13,161, respectively, of which 132 (2 per cent.) and 853 (6·5 per cent.), respectively, were diseased. Among the most resistant varieties, judged by the incidence of pod infection in 1935, were Verbesserte Vorbote, Allerfrüheste Mai, Buraus Doppelschotig, Flügel, Senator, Grünbleibende Folger, Wonder of Witham, and Ruhm von Quedlinburg, while a high degree of susceptibility was shown by Grünrock, Saxa, Mahndorfer, Peragis (field), and Schladener.

Pea rust (*Uromyces pisi*) and mildew (*Erysiphe polygoni*), in contrast to *A. pisi*, are not seed-borne but perpetuated in the vicinity of the fields, and hence are predominantly associated with the maturity of the host. In none of the years covered by the observations was the conspicuous aecidial stage of *U. pisi* absent from *Euphorbia cyparissias* [ibid., xi, p. 760], while the Erysiphaceae are well known to be capable of infecting their hosts at all times and in any place given favourable conditions and a sufficient degree of susceptibility. In general, the susceptibility of the leaves of Express Vorbote peas was found in 1934 and 1935 to increase with age. An important difference between the two pathogens lies in the duration of their activity, the rust commencing earlier than the mildew but dying out in September, whereas the latter persisted right through October.

E. cichoracearum, the agent of cucumber mildew, which is economically the most important disease of the crop in central Germany

[ibid., xix, p. 489], develops practically every year, the earliest date of observation at Aschersleben in 1930 being 18th July (100 per cent. infection a week later), in 1932 25th July (a season of mild attacks), in 1933 11th July, and in 1935 20th July. Data are presented showing that *E. cichoracearum* is liable to develop during a wet period after the cucumbers have reached a certain age and developed a sufficiency of foliage (about 10th July locally), and to be arrested by an ensuing dry spell. It is therefore advisable to treat the crops with sulphur between 10th July and 15th August.

Scab (*Cladosporium cucumerinum*) [ibid., xviii, p. 651] was particularly severe in central Germany in 1930 and 1932, reducing the harvest to a substantial extent. On the Aschersleben experimental field the disease occurred only in 1932, a count made on 7th October showing 197 out of 1,119 fruits infected (17·6 per cent.); the incidence was about twice as heavy (22·9 per cent.) on a plot receiving stable manure as on one not so treated (11·6 per cent.).

A hitherto unidentified species of *Verticillium* caused such heavy annual depredations as largely to invalidate the manuring and mildew control experiments until 1935, when it was suppressed by growing the seedlings in sterilized flower pots, in which they were subsequently transplanted.

Bremer (H.). **Beobachtungen quantitativer Art über das Auftreten von Schäden an Gemüsepflanzen auf dem Versuchsfelde der Zweigstelle Aschersleben der Biologischen Reichsanstalt für Land- und Forstwirtschaft während der Jahre 1929 bis 1935. 2. Mitteilung. Schäden an Spargel und Möhren.** [Observations of a quantitative character on the occurrence of injuries to vegetable plants on the experimental field of the Aschersleben branch of the Biological Institute for Agriculture and Forestry during the years 1929 to 1935. Note 2. Injuries to Asparagus and Carrots.]—*Z. PflKrankh.*, l, 8, pp. 402–412, 4 graphs, 1940.

This further instalment [cf. preceding abstract] of the writer's observations on the occurrence of injuries to the vegetable crops grown at the Aschersleben [Saxony] branch of the Biological Institute from 1929 to 1935 deals mainly with insect pests [*R.A.M.*, xix, p. 508], but a brief note on asparagus rust (*Puccinia asparagi*) states that the disease, conveyed to the newly laid down plots of the experimental field by teleutospores, developed year after year in a fairly severe form. Gassner and Hassebrauk have shown [ibid., xiii, p. 677] that young plantings are essential to the initiation of rust epidemics in the commercial stands, and this condition was consistently fulfilled during the period of the investigations. The importance of primary infection for the subsequent course of the disease was clearly attested in 1935, when heavy infection by pycnidia, aecidia, uredo-, and teleutospores was transmitted to a plot through dry, rusted straw.

El-Helaly (A. F.). **The effect of Rhizoctonia solani Kühn on the germination of Lettuce seed at somewhat high temperatures.**—*Proc. Linn. Soc. Lond., 1939–40*, Session 152, Pt 1, 1940.

Experiments [which are fully described] made to ascertain why the

presence of *Rhizoctonia* [*Corticium*] *solani* in autoclaved soil increased the percentage germination of lettuce seed at temperatures ranging from 25° to 30° C. gave the following data. Within this range of temperature a certain percentage of viable lettuce seeds remains dormant. If the temperature is reduced below this range, germination of the remainder up to the theoretical amount (80 to 90 per cent.) takes place at once. The treatment does not injure the seeds, but inhibits germination. The percentage of dormant seeds is lower on weak than on strong media, and the presence of the fungus in the latter increases germination. The stimulation due to the fungus appears to be unrelated to the setting-up of any particular P_H value in the medium. It was not found possible to replace the fungus by metabolic products, but on the other hand no fungal penetration of the seed was observed. Some evidence was obtained that other fungi may have a similar effect on germination.

It would appear that the dormancy of lettuce seed at the temperatures mentioned can be overcome to some extent by exposure to carbon dioxide (optimum, 2 to 5 per cent.). The same result follows from the addition to the substratum of any fungus able to produce a favourable concentration of carbon dioxide round the seeds, while liberating no deleterious products.

Pontis (R. E.). **La 'viruela' del Apio en la Provincia de Mendoza.** [Celery 'pox' in the Province of Mendoza.]—*Bol. agríc., Mendoza*, ix, 1–3, pp. 54–56, 1 fig., 1941.

A popular account is given of celery blight (*Septoria apii-graveolentis*) as it occurs in the Province of Mendoza, Argentine Republic [*R.A.M.*, xvii, p. 498], with directions for its control.

Lambert (E. B.). **Studies on the preparation of Mushroom compost.**—*J. agric. Res.*, lxii, 7, pp. 415–422, 1 fig., 1 diag., 1 graph, 1941.

In studying the effect of conditions prevailing in different areas of the compost heap on the growth of mushroom [*Psalliota* spp.] mycelium in the compost [*R.A.M.*, xx, p. 105], selected samples of compost were inoculated with mushroom spawn and incubated at 70° F. in competition with the weed moulds present in the compost. Under aerobic conditions fermentation at temperatures between 120° and 140° for 8 to 10 days produced suitable compost, while temperatures over 150° for a few hours rendered the compost unsuitable. Anaerobic fermentation produced unsuitable composts even at favourable temperatures. Under alternating composting conditions the compost tended to assume characteristics typical of the last environment to which it was subjected. Thus, a compost made unsuitable by adverse environmental conditions can again become suitable when exposed to aerobic fermentation at moderately high temperatures. It was shown in these studies that the usual method of composting in outdoor heaps results in different rates of decomposition in different layers of the heaps, and is not an efficient procedure. Under favourable conditions, in bottles, fresh manure can be converted into compost in about one-third the time required in the heap. The sweating-out period is the only part of the composting process during which nearly all of the manure is

fermenting under favourable conditions, and being the last environment to which the manure is subjected before spawning, close control of the conditions during this period is essential.

Glasscock (H. H.) & Ware (W. M.). **Investigations on the invasion of Mushroom beds by Pseudobalsamia microspora.**—*Ann. appl. Biol.*, xxviii, 2, pp. 85–90, 1 fig., 1941.

Since *Pseudobalsamia microspora* [*R.A.M.*, xviii, p. 295] was first recorded in mushroom (*Psalliota* spp.) beds in England in 1936, the authors have investigated five cases of its occurrence in this country, in three of which it was isolated directly from the soil, while in the other two circumstantial evidence suggested its introduction with the casing soil.

A simple method of testing soil for the presence of the fungus consists in packing into the lower half of a glass boiling-tube fresh pure-culture spawn of the white cultivated mushroom, slightly moistened. This is covered with a layer of about ½ in. of the (moistened) soil to be tested. The tube is plugged with cotton wool and placed in an incubator kept at 83° F. If the soil is infected, a cottony growth of cream-coloured mycelium fills the matrix of the spawn and the soil itself after about a fortnight. A few days later, ascocarps develop freely on the soil surface and throughout the contents of the tube. Six tubes are enough for each sample.

The available evidence indicates that prevention consists in avoiding the use of contaminated casing soil. In some cases, complete control results if the infected parts of the bed are removed promptly and the sites disinfected. As the fungus was found by the authors to withstand a temperature of 180° for four hours, its elimination by heat during composting or the peak period before spawning is unlikely, while steam sterilization of the casing soil would not be certainly effective. The fungus grows best at 83°, and if its presence is suspected the crop should be grown at the lowest temperature consistent with good practice. In the absence of favourable conditions for ascocarp development on the surface of the casing soil, the invader may develop in a bed without any external signs of its presence, and some of the crop failures of the past may thus be accounted for.

Parris (G. K.). **Diseases of Taro in Hawaii.**—*Circ. Hawaii agric. Exp. Sta.* 18, 29 pp., 5 figs., 1941.

The symptomatology, etiology, and control of the following taro (*Colocasia esculenta*) diseases in Hawaii are described. *Pythium* root rot [*R.A.M.*, xviii, p. 657] is responsible for reductions ranging from 10 to 100 per cent. of the crop; at a conservative estimate of 25 per cent. this represents a loss of $50 to 75 per acre. The rot usually originates at the base of the corm, which turns whitish-yellow to grey, blue, or dark purple and may assume a parallel-sided or bottle-necked shape in contrast to the normal ovoid or oblong. The pathogen persists in the soil on the refuse left on the ground after harvesting, and is favoured by high atmospheric and soil temperatures, the latter being largely determined by the distance of the irrigation water from its origin on the mountain ridges 2,000 to 6,000 ft. above soil-level, where

it is 4° to 6° F. colder than at the middle or mouth of the valleys. Of the wet-land varieties commonly grown in Hawaii, Piialii is more susceptible than Piko Uliuli, while Kai Kea and Kai Uliuli are quite resistant. Thorough ploughing and drying of the soil and the exclusion of *C. esculenta* from the crop rotation for a period of six months to a year are the best means of control, which have not so far been equalled by any chemical soil treatment, though lime at the rate of 2 to 4 tons per acre is being used by some growers with beneficial results.

Hard rot of obscure origin, and also known locally as 'guava seed' or 'black and white' disease [ibid., xvi, p. 301], is responsible for substantial losses, ranging from 5 to 100, with an average of 30, per cent., representing a financial depreciation of $60 to 80 per acre, especially in the susceptible Piko Uliuli variety. The rotted, woody, pale yellow or dirty brown tissues are usually situated in the lower third or centre of the corm, or in a number of localized hardened areas distributed all through it. The disease destroys the vascular system of the corm from the peripheral root traces inwards; the skin is of a bark-like consistency, $\frac{1}{8}$ to $\frac{1}{4}$ in. thick, deeply furrowed, friable, and coarse, dirty white to purplish, with retracted, often deeply sunken buds. The removal of the small internal lesions leaves a clean-cut, smooth, circular hole ('guava seed'), but in severe cases the entire corm is reduced to a brown or black skeletal framework. Dark-ringed 'huli' (the native name for planting material consisting of $\frac{1}{8}$ to $\frac{1}{4}$ in. of the apex of a corm with one or more buds) taken from diseased corms have been found to give rise to hard rot in the progeny, while the use of affected suckers for planting leads to similar results. In preliminary tests the dipping of the lower ends of the 'huli' in 1 : 1 : 3 Bordeaux paste gave promising results. A comparison of the stands raised from healthy and diseased planting material revealed an incidence of 40 and 70 per cent. hard rot, respectively, the disorder being more prevalent in steam-sterilized infected soil than in an unsterilized field plot. Hard rot has been observed in a severe form on land previously under *Panicum purpurascens* for upwards of five years, and may be associated with a low water-table or inadequate irrigation of the plants from the age of eight to nine months onwards. The application of lime to the soil at the rate of 2 tons per acre considerably reduced hard rot in two localities, but cannot be unreservedly recommended. Taros of the Kai group appears to possess resistance to both hard and *Pythium* rots, and may provide material for breeding experiments.

The so-called 'loliloli' (water-soaked or punky) disease, characterized by softness of the corms, which exude water and are deficient in starch, is believed to be due to the withdrawal of the latter by the leaves, a natural process sometimes deliberately stimulated by growers, to delay the ripening of the corms for economic reasons, by the application of sodium nitrate to the plants when approaching maturity. Suckers from *Pythium*-rotted plants that put out new leaves and develop individual root systems are also liable to produce water-soaked corms.

Sclerotium rolfsii causes stunting of the plants and an ochreous to brown, soft, somewhat stringy rot of the corms of upland taro, especially in over-mature or poorly irrigated stands. The ploughing-under of

infested soil to a depth of 4 to 8 in. should reduce the losses from this disease. Infected plants and the surrounding soil should be burnt, and timely harvesting is advocated.

None of the 32 varieties tested showed resistance to the destructive leaf spot caused by *Phytophthora colocasiae* [ibid., xvii, p. 731; xviii, p. 505; xix, p. 514], a conservative estimate for the average loss from which is 25 per cent. When dry, the clear, yellowish to amber-coloured liquid oozing from the dark, yellow-bordered lesions, 1 to 2 cm. in diameter, turns bright yellow or dark purple. Under humid conditions the sporangia composing the whitish efflorescence on both sides of the spots germinate on the healthy leaves, on to which they are blown by wind or splashed by rain, in three to five days. Spraying with 4–4–50 Bordeaux mixture plus a spreader at 10- to 17-day intervals has given effective control and raised the yields on Oahu by 10 to 30 per cent., while wide interspacing of the plants (at least 16 to 18 in.) is also a help in the elimination of the fungus.

Phyllosticta colocasiophila [ibid., xvii, p. 731] produces oval to irregular, buff-coloured, later dark brown, marginally zonate spots, ¼ to 1 in. or more across, on both leaf surfaces; the diseased areas decay and the centres frequently drop out. Heavy losses may arise from this source in upland taro, only one of the 27 varieties of which tested, Manini Uliuli, proved resistant. Infected material should be burnt, but spraying should only be resorted to in persistent cases of heavy defoliation.

A species of *Cladosporium* produces dark brown, diffuse spots, up to 5 or 10 mm. in diameter, on the leaves of upland varieties, especially the Japanese Tsurunoko, without, however, causing perceptible damage.

Luthra (J. C.) & Sattar (A.). **Control of Gram blight in the Punjab.**—*Indian Fmg*, ii, 2, pp. 66–69, 2 pl., 1941.

Following a summary of the economic importance, symptoms, and mode of perpetuation of gram (*Cicer arietinum*) blight (*Mycosphaerella rabiei*) [*R.A.M.*, xv, p. 700] the writers describe the control measures which have been in progress against the disease for several years past at the Agricultural Farm, Campbellpur, Punjab, with special reference to the performance of resistant varieties, notably F8 [ibid., xviii, p. 86]. The average yield of this strain, 13 maunds [1 maund = 82·284 lb.] per acre, in tracts of widespread devastation from the disease, compares favourably with that of the leading Punjab types 7 and 15. The total output from the area of 2,086 acres planted with F8 seed in 1939 amounted to 22,032 maunds, with an average yield of 10½ maunds per acre. The discovery of this type is regarded as an important contribution to the development of disease-resistant strains of Indian farm crops, and seed has been issued to the public for replacement of the local type, especially in districts where the blight has long been epidemic.

Watanabe (T.). **On the influence of hydrogen-ion concentration on the development of the atrophic fire-blight disease of the Udo Salad plant.**—*Ann. phytopath. Soc. Japan*, x, 2–3, pp. 186–191, 1940. [Japanese, with English summary.]

No relationship could be discerned between the hydrogen-ion con-

centration of the stems and leaves of Udo salad (*Aralia cordata*) and other Araliaceae and the development of atrophic fireblight (*Phoma araliae* var. *microspora*) [*R.A.M.*, xviii, p. 434], to which varieties and strains of the Kan-Udo group are susceptible and those of Haru-Udo resistant.

Osterwalder (A.). **Ein oder zwei Bespritzungen vor der Rebblüte?** [One or two sprays before Vine blossoming?] —*Schweiz. Z. Obst- u. Weinb.*, l, 12, pp. 265–269, 1941.

The writer reverts to the question of the number of sprays to be applied to vines in the Zürich district of Switzerland for protection against *Peronospora* [*Plasmopara viticola*: *R.A.M.*, xix, p. 325; cf. also xx, pp. 289, 391]. During the last 20 years, the first spots have been observed 15 times between 9th June and 1st July, the earliest outbreak having taken place on 1st June. Reckoning the period elapsing between the first and second outbreaks as 10 to 14 days, the first treatment need not be given before the middle of June. In 12 out of the 20 years covered by the observations, the vines blossomed after mid-June, in which case, supposing the initial attack to have developed about the 1st, and flowering to be delayed until the end of June or early July, two applications would be necessary, one in the middle of the month and another towards the end. Generally speaking, however, one application shortly before blossoming should suffice, entailing a total of four treatments during the season (five in exceptional years), viz., one (possibly two) before flowering, one post-blossom, and two more at 10- to 14-day intervals.

The reduced number of primary downy mildew infections in recent seasons, as compared with former years, attributable largely to more effective spraying of the lower leaf surfaces, is a further reason for the postponement of the initial treatment. In the autumn of 1940, not many old leaves bore fungal lesions, and these contained few oospores; spots were present, for instance, only in 4 out of 36 leaves of the Riesling × Sylvaner variety and 6 in 28 leaves of Blue Burgundy, while none were present in 12 of Räuschling.

These recommendations do not apply to districts in which roter Brenner [*Pseudopeziza tracheiphila*] is rife, two pre-blossom treatments being essential for the control of this fungus. The overwintered spores are discharged by the end of May or early June, necessitating a preventive application on or after 20th May, followed by the routine downy mildew spray in mid June. In the environs of Zürich, where *P. tracheiphila* at one time assumed a devastating character, the disease has latterly become a rarity thanks to the regular late May treatment.

Scott (L. E.). **An instance of boron deficiency in the Grape under field conditions.**—*Proc. Amer. Soc. hort. Sci.*, xxxviii, pp. 375–378, 1941.

In June, 1939, vines growing on Norfolk sand near Columbia, South Carolina, developed symptoms indicating boron deficiency. The leaves showed a well-developed pattern, with chlorotic areas towards the margin and between the veins. The leaf surface was rough, with raised areas between the veins, which resulted in cupping towards the under side. Some of the more severely affected vines, especially the Ontario

variety, showed an unusual development of lateral buds on the current season's shoots.

On 22nd June, 1939, a few affected vines of 10 varieties were treated with commercial borax at the rate of 10 lb. per acre, applied to the soil on either side of the vine. In July and August, the new growth was observed to be normal. The late growth on untreated vines showed little abnormality.

In May, 1940, a number of varieties untreated in 1939 showed pronounced dwarfing, with the development of several shoots from a single node, and the initiation of lateral bud growth on the short, stunted shoots. The internodes were very short and the leaves small. Flower clusters developed very conspicuously on these shoots, but were twisted, malformed, and abortive, and failed to set fruit. Applications of borax on 22nd May resulted in normal growth by 8th July, while the abnormal symptoms continued to appear on untreated vines.

The yields given in 1940 by the vines treated with borax in 1939 were 15, 2·8, 9·4, 41·8, and 5 lb. per vine (average of two to five vines) for the Catawba, Delaware, Extra, Lenoir, and Concord varieties, respectively, the corresponding figures for the untreated vines being 1·4, 0, 5·2, 2·5, and 1·3 lb., respectively.

Marked differences were noted in varietal reaction to the deficiency. The weaker varieties, such as Delaware, Ontario, and President were mostly more severely affected than the rank ones, such as R. W. Munson, Bailey, and Champion. Susceptible varieties, when grafted on vigorous rootstocks, remained unaffected.

Bryant (L. R.) & Beach (G. A.). **A preliminary study of chlorosis in American Grapes.**—*Proc. Amer. Soc. hort. Sci.*, xxxviii, pp. 395–396, 1941.

A list is given showing the degree of susceptibility to iron-deficiency chlorosis [*R.A.M.*, xx, p. 101] observed during a period of three years in 42 vine varieties grown at Fort Collins, Colorado, the most resistant group comprising Beta, Brighton, Delaware, Eaton, Elvira, Herbert, Portland, Salem, and Urbana. Champagne, Pocklington, and Lutie showed severe symptoms.

Neergaard (P.). **5. Aarsberetning fra J. E. Ohlsens Enkes Plantepatologiste Laboratorium 1 April 1939–31 Marts 1940.** [Fifth annual report of the phytopathological laboratory of J. E. Ohlsen's widow from 1st April, 1939, to 31st March, 1940.]—14 pp., 1940. [English and Esperanto summaries.]

This report [cf. *R.A.M.*, xviii, p. 572] gives details of the incidence of numerous pathogenic fungi in the 4,299 samples of vegetable seeds examined during 1939–40. The following are new disease records for Denmark: *Botrytis byssoidea* [ibid., xviii, p. 430] on leeks; *Colletotrichum circinans* on onions; *Dendryphium penicillatum* [*Pleospora calvescens*: ibid., xv, p. 743] on seeds of *Papaver nudicaule*; *Ascochyta cucumis* on cucumber; *A. asteris* on seeds of *Callistephus chinensis* [ibid., x, p. 734], the spores of the fungus measuring 6 to 9 by 2·3 to 4·5 (average 7·3 by 3·4) μ; *Alternaria dianthi* on nine flowering varieties and seed of carnation [ibid., xii, p. 707]; and *A. circinans* on *Iberis amara* var. *coronaria*

(Empress) and *I. umbellata* (vars. *lilacina* and Rose Cardinal), these being apparently new hosts for the pathogen in question.

WATERS (H. B.). **Report on the Department of Agriculture, Gold Coast, for the year 1940–41.**—10 pp., 1941.

In this report [cf. *R.A.M.*, xix, p. 261] it is stated that the cacao shade tree-planting scheme, though of less importance now that swollen shoot has been ascertained to be of virus origin [ibid., xx, p. 452], is being continued in those areas of the Gold Coast where die-back [ibid., xix, p. 390] is present, and on inadequately shaded farms.

Steps taken to control swollen shoot are as follows. A survey was made of all cacao areas near the localities where the main outbreaks have occurred to determine to what extent infection has spread. Diseased patches isolated from the chief infection centres were treated. The introduction of planting material from affected localities into healthy areas was forbidden. Finally, it was decided to establish, if necessary, zones free from cacao, to prevent the spread of the disease. It is as yet too soon to express an opinion on the effect of these measures, but infection has not reappeared in some localities treated six months ago. The surveys are providing valuable data. Twenty-six lots of planting material were prevented at gate checks on the roads from entering healthy areas. In the principal centre of infection, which covers about 400 sq. miles, direct control is already impracticable.

In the Eastern Province all nurseries laid down during past years under the cacao rejuvenation campaign were maintained, and an adequate supply of shade tree seedlings is now available in all districts. Early in the period under review, preliminary surveys were made in the Krobo, Kibi, and Kwahu districts, and up to November detailed, systematic surveys were started in the same districts and continued until the end of March, 1941. Two slight outbreaks of swollen shoot at Bunsu and a more extensive one at Kwabeng were treated by cutting out all the infected cacao together with a ring of apparently healthy trees, and spraying before and after the operation with nicotine solution. Compensation was paid to farmers for the apparently healthy trees destroyed. The somewhat extensive area isolated at Awenade was also surveyed and is first on the list for treatment. Evidence was obtained which indicated that drastic action will successfully eradicate the disease at Tafo.

A new disease of cacao, termed 'warty pod', is under investigation.

The campaign against banana Panama disease [*Fusarium oxysporum* var. *cubense*: ibid., xx, p. 342] is being actively pursued; the infection sites are still contained in the Tetrim-Nsuaem area, while there are a few infections at Abra; the northern areas are unaffected.

Very satisfactory progress has been achieved in the production of high-yielding cassava strains resistant to mosaic [ibid., xx, p. 102], and it has now become possible to recommend varieties for particular areas. Among the strains and varieties which have been thoroughly tested, the outstanding ones have been named Queen, Garri, and Sareso; the first two are suitable for the forest area, while the third is best for the northern territories.

Forty-sixth and forty-seventh Annual Reports of the Montana Agricultural Experiment Station July 1, 1938 to June 30, 1940.—65 pp., 1 map, [? 1940.]

These reports comprise a number of items of phytopathological interest, including notes on cereal diseases by A. H. Post (pp. 12–14), sugar beet diseases by H. E. Morris (pp. 20–22), and on insect transmission of bean [*Phaseolus vulgaris*] diseases by H. B. Mills (pp. 27–28). Thatcher and Pilot were recommended in 1939 as standard wheat varieties for regions of Montana where stem rust [*Puccinia graminis*] constitutes a serious problem. Pilot, produced co-operatively by the United States Department of Agriculture and the Montana, Minnesota, and North and South Dakota Agricultural Experiment Stations, is a bearded spring wheat equal to Marquis in yield, very resistant to rust, and satisfactory for milling and baking purposes.

Dwarf smut of wheat [*Tilletia caries*], recently detected in the Gallatin Valley and also occurring to a limited extent in Utah, Idaho, and Washington [*R.A.M.*, xviii, p. 441], is regarded as much more serious than ordinary bunt owing to its resistance to existing methods of seed-grain treatment. Some of the 100 varieties grown in the infested area with a view to the selection of resistant types gave very promising results and will be further tested.

A strain of oats derived from a cross between Markton and Victory has been found to combine resistance to smut [*Ustilago levis* and *U. kolleri*: see below, p. 525] and halo blight [*Bact. coronafaciens*] with other desirable commercial qualities.

During the past four years, data have been recorded on phosphate deficiency and *Fusarium* wilt in beet seedlings. All rotations with lucerne resulted in extensive seedling decay and phosphate deficiency, especially where beets immediately followed the fodder crop and manure was withheld. Wilt occurs chiefly in continuous cropping and in one-, two-, and three-year rotations, particularly on light soils.

Bean mosaic has been found to be most prevalent in plantings adjoining lucerne and sweet clover [*Melilotus*] stands, which may harbour the virus and its insect vectors. Susceptible varieties, even though carrying no infection in the seed, may rapidly contract mosaic in proximity to the fodder crops, with a consequent decrease in yield. Within the Great Northern variety, two Idaho selections and one from Montana remained free from the disease during two years' experimental exposure to insects conveying infection from commercial seed sources.

Plant diseases.—*Rep. Wis. agric. Exp. Sta., 1939–40*, Part II (*Bull.* 451), pp. 52–70, 5 figs., 1941.

This report on plant disease work in Wisconsin in 1939–40 [cf. *R.A.M.*, xvii, p. 656] contains the following items of interest, apart from those already noticed from other sources. Evidence was obtained by J. C. Walker and J. P. Jolivette that local crops which may show boron deficiency include garden beets, cabbage, cauliflower, rutabaga, and sugar beet [ibid., xvii, p. 506]. Tests indicated that on a soil sufficiently lacking in boron to cause severe heart rot of sugar beets, one application

of borax at the rate of 20 lb. per acre can be expected to afford protection for two years, while one at double or treble this rate will control the disease for three years. When borax was broadcast at rates from 10 to 60 lb. per acre on land in which sugar beets had shown medium to severe heart rot the year before, the treatment reduced the amount of disease and improved the quality of the beets, the juice of untreated and treated beets showing a purity of under 84 and about 86 per cent., respectively. The treatment also slightly increased the sugar content. In trials with 42 strains of garden beets for susceptibility to boron deficiency in three localities, the least susceptible (in all localities) were those of the Long Blood variety.

Trials by the same authors in 1939 and 1940 showed that the early cabbage varieties Golden Acre and Resistant Detroit were very susceptible to internal pith-browning due to boron deficiency, while the late-maturing All-Head Select, Wisconsin All Seasons, Wisconsin Ball Head, and Wisconsin Hollander No. 8 were least affected. In some instances, different strains of the same variety themselves differed in susceptibility. External symptoms of boron deficiency in cabbage under field conditions included a light yellow to white mottle along the margins of the older leaves, leaf-stunting, cross-hatching on the leaf petioles, one-sided leaves, partially developed leaves, and thickening of the leaf laminae. Some leaves had curled margins. Plants with these symptoms frequently produced normal new inner leaves later on. Affected plants were usually stunted.

As three years' work showed that an alkaline soil aggravates boron deficiency diseases, tests were also made of the effect of liming. The very susceptible Good-for-All beet showed increasing black spot with increased liming. On sandy soil there was no injury when the application was at the rate of 1,000 lb. [? per acre], while applications of 3,000, 5,000, and 9,000 lb. inducing P_H values of 4·9, 5·2, and 6·7, gave 14, 26, and 40 per cent. diseased plants, respectively. On silt loam, the same variety remained unaffected when 3,000 lb. lime were applied, but showed 4 per cent. diseased plants when the soil was made slightly alkaline with 6,000 lb. lime, and 40 per cent. diseased plants when the soil P_H was raised to 8 by the application of 9,000 lb. of lime. Detroit Dark Red beets remained almost unaffected on both soils under all the treatments. Experiments showed that a borax application at rates up to 60 lb. per acre is not likely to prove injurious to vegetable crops.

An extra early cabbage resistant to yellows [*Fusarium conglutinans*: ibid., xix, p. 687] has been developed, and is named Wisconsin Golden Acre.

In studies by J. C. Walker, F. J. Le Beau, O. C. Whipple, and R. H. Larson, the cabbage mosaic found locally [ibid., xix, p. 65] was ascertained to be caused by two viruses, tentatively referred to as A and B. A is largely responsible for the mosaic mottle, while B produces vein-clearing. B is largely confined to crucifers, whereas A causes mosaic on crucifers, tobacco, *Delphinium*, *Petunia*, *Calendula*, and *Zinnia*. Both A and B infect chard and spinach. Each infects cabbage independently. The disease produced by B alone is very mild, while that caused by A alone is more severe; when both are present the condition is very severe. A is rendered non-infectious by exposure to a temperature of 130° F. for

10 minutes, while B resists temperatures up to about 150° for this period.

The clover leafhopper [*Aceratagallia sanguinolenta*] was found by R. H. Larson to transmit a potato mosaic.

Greenhouse studies under controlled conditions by R. H. Larson and J. C. Walker showed that top symptoms of potato bacterial ring rot [*Bacterium sepedonicum*: ibid., xx, p. 419] become most conspicuous at temperatures of 68° to 75°. At an air temperature of 60° no disease symptoms were noted in the top growth, and diseased plants grew almost as rapidly as healthy ones. At 68°, some symptoms appeared, growth being retarded, and small bleached areas developing on the older leaves. At 75°, stunting was more severe, and the leaves showed rolling, wilting, and a yellowish discoloration. An air temperature of 82° slightly retarded the symptoms. When soil temperatures were varied, and air temperatures kept between 68° and 72°, similar results followed, except that the most severe symptoms appeared on the plants grown in soil at 82°. Young tomato plants were readily infected in inoculation tests with the potato ring rot bacterium.

Some evidence was obtained by the same authors that the early potato variety, Red Warba, and the late one, Sebago, escape serious injury from yellow dwarf [ibid., xix, p. 724].

Damping-off of conifer seedlings [cf. ibid., xviii, p. 357] in Wisconsin nurseries was found by L. F. Roth and A. J. Riker to be associated with *Pythium irregulare* and *Rhizoctonia* [*Corticium*] *solani*, both of which were ascertained to be virulent pathogens. *C. solani* caused most severe damage at temperatures between 75° and 86°, the range most favourable for the fungus, and least at 54°. *P. irregulare* showed a greater tendency to cause damping-off when the temperature was unfavourable for seedlings, even when it was also unfavourable for the fungus. It caused great damage at temperatures between 54° and 70°, at which temperatures the seedlings emerge from the soil very slowly. It appeared to be most injurious in cool weather, killing the seedlings before they appeared above the ground. To seedlings that have already emerged both fungi were most injurious at rather high temperatures. *P. irregulare* caused increasing injury as the soil moisture content increased from 13 to 100 per cent. of the moisture-holding capacity. *C. solani* was most injurious under medium soil moisture conditions (13 to 68 per cent. of moisture holding capacity). Dry soil was unfavourable to it, and it was least injurious when the soil was saturated. High air humidity favoured damping-off by *C. solani* in wet or dry soil, but had little effect on *P. irregulare*. The latter caused most damping-off at P_H 6·1 and 8·5, damage decreasing at acidities over 5·2, and reaching a minimum at 4·5. *C. solani* caused least damping-off over the range most favourable to *P. irregulare*, and was most destructive at acidities above 5·2. In the field *P. irregulare* caused most damage at P_H values between 5·85 and 7, while *C. solani* caused most at acidities over 5·85.

MATSUMOTO (T.). **Phage-produced resistant strains of Bacillus aroideae. III. Culture in soils and host plants.**—*Trans. nat. Hist. Soc. Formosa*, xxxi, 211, pp. 145–154, 1 fig., 1941. [Japanese summary.]

Most of the isolates of *Bacillus* [*Erwinia*] *aroideae* obtained from

phaged clay soils [*R.A.M.*, xx, p. 9] were found to be still susceptible to the lytic action of the bacteriophage specific for the organism, and only very rarely, if at all, is the so-called resistant form produced. The same applies to the pathogen when inoculated into disks of radish (its natural host). The titre of the phage undergoes little increase in clay soil, and the active principle rapidly deteriorates at temperatures exceeding 25° C. In the tissues of the host, on the other hand, it accumulates to an appreciable extent and maintains its activity over a longer period. Under natural conditions the bacteriophage probably persists for some considerable length of time both in the host and in the soil (at relatively low temperatures), and may assist in the reduction of the bacterial population.

Hildebrand (E. M.). **On the longevity of the crown gall organism in soil.** *Plant Dis. Reptr*, xxv, 7, pp. 200-201, 1941. [Mimeographed.]

After referring to L. C. Cochran's paper in which he adduced circumstantial evidence indicating that *Bacterium tumefaciens* may have persisted in grain land in California for 40 years [*R.A.M.*, xx, p. 292], the author cites some examples from the literature of the subject during the last 20 years of the maximum survival periods of the organism in sterilized and unsterilized soil. The longest period mentioned is 736 days, by Patel [ibid., viii, p. 554]. The writer himself possesses unpublished data from an experiment in Kansas showing that the organism survived in field soil for two years. The usual mode of dissemination of *Bact. tumefaciens* is, probably, on contaminated plants or plant parts, while the hairy root organism [*Bact. rhizogenes*: ibid., xiii, p. 776] is similarly spread. With regard to the unusual case under consideration, it is stated that the possibility of such transmission is not excluded.

Crosier (W.). Patrick (S.), & Weimer (Dolores). **Influence of phytohormones on germination and growth of cereals.**—*Proc. Ass. Off. Seed Anal. N. Amer. 1940*, pp. 83–86, 1941.

In work at Geneva, New York, Honor winter wheat seed dusted with new ceresan (diluted with talc to give a 1 per cent. ethyl mercury phosphate dust), indolebutyric acid (100 p.p.m.), the same with new ceresan, indolebutyric acid (200 p.p.m.), the same with new ceresan, indolebutyric acid (300 p.p.m.), and the same with new ceresan showed, respectively, 64·4, 67·2, 60·8, 73·4, 67·2, 64·2, and 61 per cent. emergence, as compared with 65·8 per cent. for the untreated controls. The same treatments gave, respectively, 338, 348, 312, 349, 312, 328, and 310 heads per 100 seeds, as against 328 in the untreated controls. Details are given of other experiments with α-naphthalene-acetamide, indoleacetic acid, and new ceresan on seeds of Honor wheat.

While the data obtained were not consistently uniform, they show that neither indoleacetic acid, indolebutyric acid, nor α-naphthaleneacetamide induces significant increases in germination, winter survival, or seedling weights of treated wheat.

Sukhov [Sukhoff] (K. S.). **On the virus proteins in cereals.**—*C. R. Acad. Sci. U.R.S.S.*, N.S., xxix, 2, pp. 137-138, 1 fig., 1940.

Winter wheat growing near Moscow was found to be affected by a

form of mosaic, the external symptoms of which resembled those of the winter wheat mosaic recently reported from Voronezh [*R.A.M.*, xx, p. 396]. Some of the outward symptoms distinguished it from 'zakooklivanie' disease of oats [ibid., xx, p. 156], from which it differed sharply in the absence of protein inclusions from the cells of affected plants. Sections of wheat leaves affected with mosaic, however, when placed in an acid medium, developed numerous needle-shaped crystals up to over 10 μ in length. Microchemical reactions indicated the protein nature of the crystals and their identity with the virus of winter wheat mosaic. The view that the wheat mosaic found near Moscow is probably identical with that reported from Voronezh was supported by the fact that crystals identical with those found in the Moscow wheat were observed in the intestines of *Deltocephalus striatus* [ibid., xix, p. 268], the vector of the Voronezh mosaic.

Watson (I. A.). **Inheritance of resistance to stem rust in crosses with Kenya varieties of Triticum vulgare Vill.**—*Phytopathology*, xxxi, 6, pp. 558–560, 1941.

A study was initiated at the University of Sydney, in collaboration with W. L. Waterhouse, to determine the mode of inheritance of resistance to *Puccinia graminis tritici* in wheats of Kenya origin [*R.A.M.*, xix, p. 394]. Hybrid material obtained in the course of the investigations was tested in the field at St. Paul, Minnesota, in 1939 and 1940 for its reactions to at least 30 physiologic races of the rust. Two varieties, Kenya 744 and 745, were crossed with two susceptible Australian wheats, Federation 107 and Dundee 985. In 1939 the predominant races involved in the epidemic in the breeding nursery were 11, 17, 34, 36, 47, and 56, and in 1940, 15, 17, 34, 36, 49, 56, and 147. Federation 107 seedlings are fairly resistant to race 38, and the inoculation of 85 F_3 lines showed that the same gene controls both susceptibility to race 56 and moderate resistance to 38. A single factor for resistance to *P. graminis tritici* was found to be operative in both the Kenya varieties, irrespective of the particular susceptible parent used in the cross. An analysis of the F_1 plants from each of the crosses denoted that resistance is only partially dominant. The inoculation of F_3 seedlings of a cross between the two Kenya varieties with race 17 resulted in the development of a susceptible class, indicating the independent inheritance of factors for resistance to this race in 744 and 745. Kenya 744 has consistently proved to be somewhat more resistant than 745, the former being classed as moderately, and the latter as semi-resistant in 1940, representing a slight decline in resistance as compared with 1939.

White (N. H.). **Physiological studies of the fungus Ophiobolus graminis Sacc. I. Growth factor requirements.**—*J. Coun. sci. industr. Res. Aust.*, xiv, 2, pp. 137–146, 2 graphs, 1941.

Continuing his studies at the Division of Plant Industry, Canberra, on *Ophiobolus graminis*, the agent of take-all of wheat [*R.A.M.*, xix, p. 141], the writer ascertained that biotin is indispensable to its development, while the further addition of thiamin (aneurin) doubled the amount of growth, 0·1 mg. per 100 ml. of solution being the optimum for both the vitamins (H and B, respectively). The growth factors are

present in the optimal quantities in extracts of wheat roots and straw and in 0·5 per cent. peptone [ibid., xvi, p. 373]. Soil extracts were found to be deficient in both the vitamins, as was also a 0·05 per cent. 'marmite' solution, though a 0·1 per cent. concentration of the latter contained a sufficiency of biotin. Asparagin appears to rank with wheat root and straw extracts and peptone as a source of nutriment for the pathogen.

The inability of *O. graminis* to persist in the soil in a purely saprophytic condition is attributed, on the one hand, to its dependence on specific growth factors obtainable only through the host, and on the other, to its susceptibility to the staling substances given off by many soil micro-organisms [cf. ibid., xviii, p. 733 *et passim*].

Mead (H. W.). **The disinfecting value of fungicides used for treating cereal seeds and their influence on growth.** —*Sci. Agric.*, xxi, 11, pp. 717–726, 1 fig., 2 graphs, 1941.

To test the effect of temperature on the disinfectant value of cereal seed disinfectants seed of Mindum wheat, Hannchen barley, and of an unknown variety of oats were treated with new improved ceresan, half-ounce leytosan [see next abstract], and formalin, the treated seed stored at room temperature for a week, and the kernels then plated on acidified potato dextrose agar (P_H 6), the cultures being incubated at 10°, 15°, and 25° C.

Fungal growth from the treated kernels was slow or nil at 10°, faster at 15°, and still more rapid at 25°, but was always slower and less profuse than on control kernels. Presumably the fungicides killed fungi on the surface of the seeds, but did not affect hyphae within the seed and the fact that fungi developed from treated kernels after incubation at all temperatures (except at 10° with seed treated with new improved ceresan), though less freely at the lower, supports this view. These results indicate that the effectiveness of the fungicides was influenced by temperature, and that some seed-borne fungi survived seed treatment, though their development was delayed.

In a field experiment, samples of wheat seed from 12 farms, relatively free from disease (two samples showing light infection with *Helminthosporium sativum*), were each divided into four portions which were sown in three different localities (*a*) untreated, (*b*) treated with new improved ceresan, (*c*) half ounce leytosan, and (*d*) formalin. Emergence and yield data [which are tabulated] showed that the samples reacted differently to the treatments, and that the effects of the treatments differed in the three localities, apparently owing to differences in soil type and soil moisture. Formalin treatment caused significant reduction of stand and yield, while new improved ceresan increased both, apparently significantly, and half ounce leytosan increased them slightly.

In another field test barley bearing *H. sativum* on 95 per cent. of the kernels was sown (*a*) untreated, (*b*) treated with new improved ceresan. In contrast to the previous experiment, treatment in this case significantly improved the stand and increased the yield by reducing infection throughout the season.

It is concluded that some of the differences in the infection of cereal seedlings which occur from year to year, and the apparent failure of

fungicidal control, may be due to fluctuations in soil temperature. Complete control by seed treatment of fungi borne internally cannot be expected when the soil temperature is high. The delay in the development of internally borne fungi at low temperatures in comparison with the rate of development of the seedlings is largely due to temperature, which affects both host and fungus. If the seed is sown in soil at about 12°, conditions are much more favourable for the seedling than for fungi such as *H. sativum* and *Fusarium culmorum*, for example, whereas at 20°, the optimum for the growth of these fungi, seedling infection may be severe on wheat.

Machacek (J. E.) & Greaney (F. J.). **Further experiments on the control by seed disinfection of root-rotting fungi in Wheat.** – *Phytopathology*, xxxi, 5, pp. 379–394, 1941.

The outstanding results of the writers' continued and extended investigations from 1935 to 1939 at the Dominion Laboratory of Plant Pathology, Winnipeg, on the value of seed-grain disinfection in the control of *Fusarium culmorum* and *Helminthosporium sativum* on wheat were (1) that healthy seed does not respond favourably to treatment with organic mercury compounds, and (2) that the effects of such treatment on seed infected by root-rotting fungi, though often very beneficial, are liable to be inconsistent. The various dusts used, including new improved ceresan, leytosan, half-ounce leytosan, methyl mercury chloride, methyl mercury nitrate, methyl mercury iodide, and Berk IV 39 (F. W. Berk & Co., Ltd., London, England), did not differ appreciably in their influence on the percentage of seedling emergence, the incidence of root rot in the stands, and the wheat yield. Applied to healthy seed, the tests tended to reduce yields, but were without effect on seedling emergence or the development of root rot. In the case of artificial inoculation by *F. culmorum* or spontaneous infection by *H. sativum*, seedling emergence was uniformly improved by seed disinfection, which was further usually instrumental in the reduction of root rot and the increase of grain. The incorporation of ammonium phosphate with the soil increased the yield from healthy seed, and no additional advantage resulted from a combination of the fertilizer with chemical disinfection of the seed.

Harris (R. H.), Sibbitt (L. D.), & Brentzel (W. E.). **Blight and other damage of durum Wheat in 1940.** *Bull. N. Dak. agric. Exp. Sta.* 296, 14 pp., 3 figs., 1941. [Abs. in *Exp. Sta. Rec.*, lxxxv, 1, p. 70, 1941.]

In the first part of this study R. H. Harris and L. D. Sibbitt found that blight [*Gibberella saubinetii*] and other forms of fungal infection, including *Helminthosporium*, *Alternaria*, and *Fusarium*, adversely affected the quality of the macaroni and semolina obtained from durum wheats in North Dakota in 1940, the principal damage consisting in speckling of the semolina and lack of colour in both products. The semolina yield was also less.

In the second part, W. E. Brentzel records damage to durum and hard wheat seed-grain by black point due to *Alternaria* and *Helminthosporium* and from other agencies, including *G. saubinetii*, bacteria, weakly or non-parasitic moulds, and weathering. Ceresan treatment

improved seed germination and seedling vigour. Most of the organisms encountered were kinds not originating with the seed from which the plant grew and therefore unlikely to develop in crops resulting from sowing damaged seed, but the mouldy condition of a large part of the grain and the prevalence of smut [? bunt = *Tilletia caries* and *T. foetida*] were such as to render disinfection advisable.

Ho (W. C.), Meredith (C. H.), & Melhus (I. E.). **Pythium graminicola Subr. on Barley.**—*Res. Bull. Ia agric. Exp. Sta.* 287, pp. 289–314, 7 figs., 1 graph, 1941.

Studies carried out in Iowa on barley root rot caused by *Pythium graminicola* [*R.A.M.*, xvii, p. 384] showed that the chief symptom in the field was the presence of yellow, dwarfed plants with decayed root terminals. The infected roots rapidly disintegrated. In very severe infections, the seedling fell over, dried up, and disappeared. As the season progressed, the stunted plants headed 'shorter' than healthy ones, and were conspicuously yellow, while the small tillers were dead. The lower leaves died and disappeared, and the new ones formed rosettes. Seriously affected plants stooled excessively, but few stools developed culms. The culms that succeeded in heading turned brown and dried up, and the grain was shrivelled and light and gave a seriously reduced yield.

The disease was very severe in 1936 and 1938. Seedling injury was greater at high than low temperatures, the fungus growing only very slowly at 15° C.

Oogonia and antheridia were observed in over 80 single zoospore cultures. The optimum temperature for mycelial growth in culture appeared to be 25° to 30°, the maximum between 35° and 40°, and the minimum between 5° and 10°. Data from field and greenhouse tests indicated that, of ten varieties of barley, Ministurdi was the most resistant.

Reed (G. M.). **Inheritance of smut resistance to some Oat hybrids.**—*Amer. J. Bot.*, xxviii, 6, pp. 451–457, 1941.

In further studies on the inheritance of resistance to loose and covered smuts, *Ustilago avenae* and *U. levis* [*U. kolleri*: *R.A.M.*, xx, p. 393], in oat hybrids, data were obtained for the progeny of five crosses. The inheritance of resistance to race 1 of *U. avenae* in Hybrid 81 (Gothland (susceptible to race 1) × Black Mesdag (resistant)), Hybrid 85 (Danish Island (very susceptible) × Black Mesdag), and Hybrid 87 (Green Mountain (susceptible) × Monarch (resistant)) appeared to depend on a single factor, about 25 per cent. of F_2 plants showing infection and the F_3 progenies being distributed approximately on the basis of one resistant, two segregating, and one susceptible. Inheritance of resistance to race 1 of *U. kolleri* in Hybrid 80 (Canadian (susceptible to this race) × Monarch Selection (resistant)), and race 3 of *U. kolleri* in Hybrid 87 (Green Mountain (resistant) × Monarch (very susceptible)) also depended on a single factor. In Hybrid 80 and Hybrid 86 (Monarch Selection × Gothland) both the second and third generations were as susceptible to race 1 of *U. avenae* as the parental varieties both of which were susceptible to this race. In Hybrid 81 and Hybrid 86 both parents are resistant

to race 1 of *U. kolleri*, but while the F_2 and F_3 of the latter showed complete resistance, the data for the F_3 generation of the former indicate that the inheritance of resistance to covered smut in this hybrid depends upon three different factors. The parents of Hybrid 87 show a contrasting reaction to race 1 of *U. avenae* and race 3 of *U. kolleri*, and the single factors governing resistance to each smut were independent of each other.

Holton (C. S.) & Fischer (G. W.). **Hybridization between Ustilago avenae and U. perennans.**—*J. agric. Res.*, lxii, 2, pp. 121–128, 1941.

When *Ustilago avenae* and *U. perennans* (which have no known common host) were hybridized by inoculating wild oats (*Avena fatua*) with compatible monosporidial combinations of both species, the wild oats were infected, but no infection resulted from similar inoculations of Victory oats and tall oatgrass (*Arrhenatherum elatius*). *U. avenae* infected Victory oats and wild oats, but not tall oatgrass, while *U. perennans* infected tall oatgrass, but not Victory oats or wild oats.

Segregates with a pathogenicity similar to that of the *U. avenae* parent were recovered from the hybrid chlamydospores by inoculating Anthony oats, but segregates behaving like the *U. perennans* parent were not recovered from similar inoculations on tall oatgrass.

When the sexually opposite monosporidial lines of *U. perennans* were paired with *U. avenae*, *U. levis* [*U. kolleri*], and *U. hordei*, two different degrees of compatibility were shown, viz., sporidial fusion followed by the production of infection hyphae, and sporidial fusion without the production of infection hyphae. Infection of wild oats was given by the former type, but not by the latter.

Avizohar (Zehara). **Inoculation of Rye with Claviceps purpurea in Palestine.**—Reprinted from *Palest. J. Bot.*, R Ser., iii, 1–2, 2 pp., 1 fig., 1940.

Ergot (*Claviceps purpurea*) has not been recorded under natural conditions in Palestine either on rye or wheat [or apparently on any other host]. In Russia the fungus is widespread in the northern parts of the country, but seldom occurs in the south and south-east. It was considered of interest, therefore, from the phytopathological-ecological point of view to ascertain whether the disease could develop in Palestine. Accordingly in May, 1940, summer rye of the *multicaule* type was inoculated at the Rehovot Agricultural Research Station with tap water suspensions of conidia of *C. purpurea* (of English origin) from potato dextrose agar cultures, the inoculum being applied to the flowers by means of a brush as recommended by Kirchhoff [*R.A.M.*, viii, p. 560]. Four typical sclerotia developed after 20 days on one of the 20 treated plants sown at a depth of 5 cm. and maintained in an excessively humid atmosphere.

Ullstrup (A. J.). **Two physiologic races of Helminthosporium maydis in the Corn belt.**—*Phytopathology*, xxxi, 6, pp. 508–521, 6 figs., 1941.

Two morphologically indistinguishable races of *Helminthosporium maydis* (*Ophiobolus heterostrophus* [*R.A.M.*, xviii, pp. 245, 444]) have been recognized at the Indiana Agricultural Experiment Station on the

basis of host specialization, symptomatology, and virulence, namely, 1, limited in its parasitism to one inbred line of maize (Pr.) and 2, with a somewhat wider host range, extending to line 187-2 and a number of proprietary inbreds; this race produces distinct symptoms on the foliage of its hosts, milder than those associated with race 1 and consisting in irregular, elongated, coalescent, necrotic, chocolate-brown spots, up to 20 by 3 mm. The lesions caused by race 1 are straw-coloured, of a dry, papery texture, with concentrically zonate, light to purplish-brown margins, up to 20 by 5 mm.; the profuse fructifications of the fungus under humid conditions impart a greenish-black cast to the infected areas, especially on the leaf sheaths, husks, and round the stalk nodes, while *en masse* the diseased plants present a mottled, dead, greyish-green appearance. Both races induce a black discoloration of the ears due to mycelial invasion through the tip or butt of the ear or directly by way of the husk, and the small, purplish spots developing on sugar-cane, rice, sorghum, and Sudan grass as a result of inoculation with either of the two races are indistinguishable.

It is suggested that race 1 may be indigenous to the Corn Belt, escaping notice until the severe outbreaks of 1938 and 1939 owing to its sparse development on open-pollinated plants, or it may have led a saprophytic existence pending the production of a hybrid homozygous for susceptibility. Another possibility is that it may have arisen as a mutant from the less specialized type of the pathogen known to occur in Florida [ibid., v, p. 293]. Race 2 may likewise be a native of the Corn Belt, overlooked on account of its low virulence until a relatively susceptible host developed under appropriate environmental conditions. Both races appear to be seed-borne.

Elliott (Charlotte). **Bacterial wilt of Corn.**—*Fmrs' Bull. U.S. Dep. Agric.* 1,878, 21 pp., 12 figs., 1 map, 1941.

Maize bacterial wilt (*Aplanobacter* [*Xanthomonas*] *stewarti*) [*R.A.M.*, xix, p. 698; xx, p. 109] in some years and in certain parts of North America causes almost complete losses of early varieties of sweet maize, such as Golden Bantam. The use of new resistant hybrids has almost solved the wilt problem as regards sweet maize, but in 1932 the disease, in a rather different form, began to threaten field maize. In 1932 and 1933 it appeared as a leaf blight on dent maize in Indiana and Illinois, infection increasing the susceptibility of the plants to stalk rot by *Diplodia* [*zeae*: ibid., xii, p. 563]. In 1938 and 1939 leaf blight again developed on dent maize in the Central States, causing losses of up to 20 per cent. in certain new hybrids.

The disease occurs throughout the maize-growing sections of the United States and has been reported from Puerto Rico, South Africa, Mexico, and Italy. In the United States the greatest losses occur in the area from Long Island to Virginia and westward, and a detailed history is given of the wilt epidemics in the United States since its first record in Long Island in 1895.

The symptoms of the disease on sweet and dent varieties are described and figured, and an account is given of how the bacteria overwinter in the beetle *Chaetocnema pulicaria* and how the disease is spread almost exclusively during the growing season by this beetle,

though wilt bacteria may overwinter in the seed to a limited extent and thereby be introduced into new areas. Few if any plants become infected through the soil, though *X. stewarti* may occasionally live over winter in soil, manure, and old maize stalks. The only feasible method of control lies in the use of resistant varieties. The sweet maize hybrid Golden Cross Bantam is resistant to early infection and widely adaptable to different soil and climatic conditions, but is too late for the earliest market, though for canning purposes it is the most widely used yellow sweet maize variety. The parents are now being used in other sweet maize crosses, in the hope that an earlier hybrid of equal qualities in other respects may be developed. Lists of new sweet maize hybrids suited to certain localities are obtainable, and some experiment stations maintain seed true to type available to commercial growers.

Marked differences in the incidence of wilt occur from season to season, and weather records offer some explanation of the variation [ibid., xvii, p. 105; xviii, p. 588; xix, p. 467]. In the northern States, where wilt is less abundant and winter temperatures are lower, the disease can be eliminated by one severe winter, whereas farther south a series of cold winters is apparently necessary to cause decided decreases in wilt. A succession of mild winters tends to build up wilt to epidemic proportions.

Stevens (N. E.) & Haenseler (C. M.). **Incidence of bacterial wilt of sweet Corn, 1935–1940 : forecasts and performance.**—*Plant Dis. Reptr*, xxv, 6, pp. 152–157, 4 maps, 1941. [Mimeographed.]

Experimental forecasts of the probable incidence of bacterial wilt (*Phytomonas* [*Xanthomonas*] *stewarti*) [see preceding abstract] of sweet maize in the eastern United States based on the mean temperatures of the preceding winter [*R.A.M.*, xiv, p. 160] are now to be discontinued, since the results obtained during 1935 to 1940 have shown that the correlation has been so close that general forecasts can have little further interest and as local forecasts are more easily prepared and more useful. A summary is given of forecasts made and the actual occurrence of infection for each of these years is described. In 1940, the disease caused no commercially significant losses on sweet maize on the eastern seaboard north of central New Jersey, and none in Ohio or Indiana. Infection was, however, prevalent south of Pennsylvania.

Hoppe (P. E.). **Relative prevalence and geographic distribution of various ear rot fungi in the 1940 Corn crop.**—*Plant Dis. Reptr*, xxv, 6, pp. 148–152, 1 graph, 1941. [Mimeographed.]

The 1940 platings on potato dextrose agar of samples of damaged maize kernels taken from car-loads at terminal markets in the United States [cf. *R.A.M.*, xix, p. 589] showed that in Maryland and Delaware the results were markedly different from those in earlier surveys. *Diplodia zeae* accounted for only 16·2 per cent. of the damaged grain, *Gibberella saubinetii* for 21·6 per cent., and *Fusarium moniliforme* [*G. fujikuroi*] for 17·5 per cent. The corresponding percentages for Kentucky and Tennessee (together) were 42·9, 1·1, and 50·3, respectively; for Ohio, Indiana, Illinois, and Michigan (together), 64·6, 2·6, and 14·3, respectively; for Minnesota, Iowa, and Missouri (together), 57·4, 9·5, and 22·8, respectively; for Arkansas, Oklahoma, and Texas

(together) 28·6, 0, and 53·3, respectively; and for Nebraska, Kansas, and Colorado (together) 6·1, 0·2, and 72·0, respectively. A certain unidentified fungus always found in damaged grain samples from the seaboard States of Maryland and Delaware was plated from 10·2 per cent. of the damaged grain. In Kentucky and Tennessee, the ratio of *D. macrospora* to *D. zeae* was roughly 1 to 19. Data are also given on other less important pathogens.

Cushing (R. L.), Kiesselbach (T. A.), & Webster (O. J.). **Sorghum production in Nebraska.** –*Bull. Neb. agric. Exp. Sta.* 329, 58 pp., 16 figs., 6 graphs, 4 maps, 1940.

This bulletin contains (pp. 51–53) a section on sorghum diseases prepared by J. E. Livingston. Covered kernel smut [*Sphacelotheca sorghi*] is the only constant source of severe damage to the crop in Nebraska, though considerable injury may be caused in certain years by loose smut [*S. cruenta*], head smut [*Sorosporium reilianum*], weak neck [*R.A.M.*, xx, p. 359], *Pythium* [*arrhenomanes*] root rot or milo disease, and bacterial leaf blights. Varietal field tests in connexion with weak neck, the importance of which is stated to be on the increase, indicated a considerable degree of resistance in Wheatland, Blackhull kafir, Club, and all true sorgos.

Bitancourt (A. A.). **A leprose dos Citrus.** [Citrus leprosis.]—*Biologico*, vi, 2, pp. 39–45, 1 fig., 1940.

Leprosis is stated to be one of the most serious diseases affecting citrus in São Paulo and other regions of Brazil, including Minas Gerais and Rio Grande do Sul. The malady has also been recorded from the Argentine, Paraguay [*R.A.M.*, xx, p. 110], Uruguay, United States, China (south), Japan, India (north), Ceylon, the Philippines, Java, Lower Egypt, and South Africa. The symptoms of leprosis in São Paulo are mainly confined to the leaves and fruits, the former bearing circular to elongated, concentrically zonate lesions, 0·4 to 1·2 cm. in diameter, slightly salient on the upper surface, pale green in the centre and translucent yellowish round the periphery, imparting the effect of a halo. The affected tissues shrivel, darken, and become infected by saprophytes or weak parasites, such as *Colletotrichum gloeosporioides*. In other cases the spots are less conspicuous, but cover a larger area of the leaf surface, appearing as elliptical to irregular chlorotic areas, 1 to 2 cm. in diameter, distributed at random or localized in the lower third or half of the leaf, and surrounded by faint lines of a darker colour. On orange fruits small, yellow spots with darker centres appear when a diameter of 4 to 5 cm. is attained, and after undergoing a series of transformations develop on ripe fruits into lesions of a uniformly dark chestnut or black colour, 0·5 to 1 cm. in diameter. The concentrically zonate spots on the shoots, yellowish or pale green at first, ultimately darken to chestnut-red or chocolate colour, sometimes only round the periphery, which is more prominent than the rest of the lesion; at this stage the affected zones are elongated and measure 0·5 to 2 cm. in diameter. Gum is formed below the lesions both on the shoots and foliage, so that they appear as intumescences. Finally the darker portions of the lesions shrivel and may peel off, or the central part turns ashen- or pale grey and splits in a

longitudinal direction. The branches sometimes exhibit rough, desquamating areas liable to confusion with those due to psorosis. The prominence of foliar and fruit symptoms, as compared with those of the shoots and branches, is a distinguishing feature of leprosis in São Paulo.

The varying degrees of susceptibility of different species of citrus to leprosis in different regions is considered to denote the existence of distinct forms of the virus. In São Paulo, for instance, oranges are highly susceptible and tangerines immune, whereas the latter are subject to infection in the Argentine, though more resistant than the sweet orange. Limes of various kinds may be frequently observed in a perfectly sound condition in proximity to severely infected oranges, but they all occasionally show foliar lesions indicating the presence of a form of the virus capable of attacking limes. Lemon fruits bear deeply sunken lesions which exude gum and induce even more acute malformation than in oranges. The pomelo, rough lemon, and sour orange may also contract infection, but are generally regarded as very resistant.

The virus responsible for leprosis, a member of the 'ring spot' group, was found to be transmissible by an Acarid of the genus *Tenuipalpus*, 40 to 70 per cent. of the plants in pots situated near a severely diseased orange becoming infected, except in the case of the Sabará variety, in which only 3 out of 50 developed foliar lesions, while the tangerines remained immune. Fruits 3 cm. in diameter gathered in January were found to be free from infection on reaching maturity, whereas 80 per cent. of those remaining on the tree developed leprosis.

Drastic pruning of the diseased shoots and leaves has given excellent results in São Paulo, but is attended by one drawback, namely, the loss of the next one or two crops; this may be remedied by advancing the harvest, so as to enable the work of excision to be carried out in June, and a new flush of leaves will be formed in the following September. The areas of the trunk exposed to the sun's rays by the removal of the foliage should be treated with Bordeaux paste (1 kg.—1kg.—6l.) to obviate the formation of cankers. One or more applications of 1 per cent. Bordeaux mixture should be given in September and December. The cultivation of the resistant Sabará orange is recommended in new plantings.

Bitancourt (A. A.). **O tratamento da leprose dos Citrus.** [The treatment of Citrus leprosis.]—*Biologico*, vii, 6, pp. 149-152, 1941.

An account is given of experiments in the control of leprosis of sweet oranges in São Paulo, Brazil [see preceding abstract], by means of 1 per cent. lime-sulphur, 1 per cent. oil emulsion (citrol), and Bordeaux mixture, the first-named substance having been successfully used for the same purpose by Frezzi (*Bol. Minist. Agric., B. Aires*, 1940), in the Argentine, where the disease was found to be transmissible by *Tenuipalpus pseudocuneatus*. The trees sprayed with 1 per cent. Bordeaux mixture from October, 1939, to May, 1940, suffered such heavy damage from infestation by cochineal insects, principally *Lepidosaphes pinnaeformis*, that the treatments had to be discontinued. Both the lime-sulphur and oil emulsion sprays produced completely healthy fruits, indicating that the spotted leaves observed at the outset of the trials must have fallen and that the virus was not perpetuated in the newly formed buds. In the untreated control block 15 out of the 24 plants

developed symptoms of leprosis, involving any fruits formed after the commencement of the experiments. One of the plants was regularly attacked by *Coccus viridis*, which was parasitized by *Cephalosporium* [or *Verticillium*] *lecanii* [*R.A.M.*, xix, p. 91] and a sooty mould (Capnodiaceae).

As a result of these tests, the author advocates the lime-sulphur treatment as an alternative to drastic pruning in mildly affected groves or even in more severe cases where the sacrifice of the forthcoming crop is undesirable. Spraying should preferably be carried out in October, January, and March. Mention has already been made of the highly resistant, in fact quasi-immune Sabará variety, as suited to new plantings, but for purposes of export such commercial varieties as Pêra or Baíaninha must of course continue to be grown.

Oberholzer (P. C. J.). **Suspected magnesium deficiency in Citrus.**—*Fmg S. Afr.*, xvi, 184, pp. 235–236, 2 figs., 1941.

Mature leaves of citrus trees in South Africa show a fading of the chlorophyll along the central part of the midrib, resulting in a gradual leaf-yellowing. The discoloration is mainly confined to the basal part, but as the yellowing spreads there sometimes remains a green area in the shape of an inverted V at the base of the leaf, particularly in grapefruit, the wings of the petiole generally remaining green after the whole leaf has yellowed. In severe cases, the entire leaf turns bronze and falls.

The chlorosis occurs to an alarming extent in the White River, Plaston, Karino, Mayfern, and Nelspruit areas of the eastern Transvaal, where some orchards show over 50 per cent. affected foliage. This results in gradual deterioration of the tree, followed sometimes by reduced yields. It has also been observed in the Rustenburg and Letaba citrus areas, and at Paarl and Groot Drakenstein in the western Cape Province.

A detailed study of the condition indicated that it is due to magnesium deficiency. Affected trees appear to occur on acid soils with low available magnesium. The chlorotic leaves invariably contain less magnesium than normal ones. In sand cultures similar symptoms were produced on trees presumably initially low in magnesium by omitting this element from the culture solution. Further investigations are in progress.

The Citrus canker situation.—*Plant Dis. Reptr*, xxv, 5, pp. 140–141, 1941. [Mimeographed.]

In the campaign against *Phytomonas* [*Xanthomonas*] *citri* [*R.A.M.*, xvii, p. 125], during the period from 1937 to 1940, 279 diseased citrus trees were found in Texas and 865 in Louisiana. In 1940, only one infected property was found in Texas, and one in Louisiana. No canker has been found in recent years in any locality in the United States where citrus-growing is carried on commercially.

Armstrong (G. M.). **A solution-culture infection method used in the study of Fusarium wilts.**—*Phytopathology*, xxxi, 6, pp. 549–553, 1 fig., 1941.

The following methods provided uniformly high percentages of infection on cotton seedlings in inoculation experiments with *Fusarium*

vasinfectum at the South Carolina Agricultural Experiment Station [*R.A.M.*, xix, p. 592]. In the first series of tests the seed was germinated in sterilized sand in trays, and the most vigorous seedlings dipped into nutrient solution cultures of the pathogens for periods ranging from 10 to 90 minutes, after which they were transferred to regular nutrient solutions. The high percentage (37·5) of re-isolations, even of weak isolates of the fungus from a resistant variety (Sea Island), indicates that this technique affords conditions approximating to those of severe field infection. The tank or tray method represents an attempt at the further simplification of seedling production for inoculations. Soaked seed is grown in boiled and soaked 'excelsior' [wood-wool packing material] placed over the wire netting of $\frac{1}{4}$ in. mesh attached to the lower edge of a wooden frame fitted tightly into a metal tray, 21 by 13 by 8 in., to the depth of 1 in. and the roots allowed to grow into the water or nutrient solution below. Inoculations were made by dipping the roots in a nutrient solution culture of the pathogen in another tray 3 in. deep, which resulted in 80 to 100 per cent. infection. This method permits the use of a large number of plants per unit area and is also applicable to tobacco, beans [*Phaseolus vulgaris*], and cowpeas.

Lima (A. O.). **Considerações de ordem immunologica sobre a pathogenicidade do genero Monilia.** [Considerations of an immunological order on the pathogenicity of the genus *Monilia*.]—*Brasil-med.*, lv, 17, pp. 301–305, 1941.

This is a survey of recent important contributions to the immunization of patients against pathogenic species of *Monilia* [*Candida*] by means of injections of oidiomycin.

Swartz (J. H.) & Jankelson (I. R.). **Incidence of fungi in the stools of non-specific ulcerative colitis. Preliminary report.**—*Amer. J. digest. Dis.*, viii, 6, pp. 211–214, 3 figs., 1941.

Yeast-like fungi, including *Geotrichum versiforme* [*R.A.M.*, xiii, p. 636] and *Monilia* [*Candida*] *albicans*, were isolated on Sabouraud's medium from the faeces of 21 out of 24 cases (87·5 per cent.) of non-specific ulcerative colitis at Boston, Massachusetts, the corresponding incidence in a control group being 8 (33·3 per cent.). There is no evidence that *G. versiforme* is implicated in the etiology of the disease, but *C. albicans* appears to be of prognostic significance, denoting a malignant course and possibly fatal termination of the illness.

Toone (E. C.). **Torula histolytica (Blastomycoides histolytica) meningitis: report of a case with recovery.**—*Virginia med. Mon.* (formerly *Semi-Mon.*), lxviii, 7, pp. 405–407, 1941.

Torula histolytica [*Debaryomyces neoformans*: *R.A.M.*, xx, pp. 363, 406] was cultured from the spinal fluid and urine of an 18-year-old negress suffering from meningitis at the St. Philip Hospital, Richmond, Virginia. The patient survived the acute phase of the disease, which responded to intravenous iodide treatment, but two years later the organism was still present in the spinal fluid.

Ghosh (L. M.). **Notes on common skin diseases. I. Ringworm of the foot.**—*Indian med. Gaz.*, lxxvi, 3, pp. 155–156, 1941.

Epidermophyton floccosum is stated to be the principal agent of ringworm of the foot in India. The clinical features of the disease and the factors affecting its incidence are described, and prophylactic and therapeutic measures recommended.

Ghosh (L. M.). **Notes on common skin diseases II. Ringworm of the scalp.**—*Indian med. Gaz.*, lxxvi, 5, pp. 268–270, 1941.

Juvenile ringworms of the scalp in India are of three types, caused, respectively, by *Microsporon*, *Trichophyton*, and *Achorion* spp., the last-named to form the subject of a separate communication. Microsporosis and trichophytosis are almost exclusively confined to European, Anglo-Indian, Jewish, and Armenian children in hill station schools, the rare cases observed among natives in the plains being due to *T. violaceum* [*R.A.M.*, xviii, p. 522]. Directions for differential diagnosis and therapy of the disorders in question are given.

Delamater (E. D.). **Experimental studies with the dermatophytes. III. Development and duration of immunity and hypersensitivity in Guinea Pigs.**—*J. invest. Derm.*, iv, 2, pp. 143–158, 1941.

Continuing his inoculation experiments with dermatophytes [cf. *R.A.M.*, xix, p. 92], the writer studied the effects of *Trichophyton gypseum* on guinea-pigs at the College of Physicians and Surgeons, Columbia University, New York. Allergy to the fungus was found to increase gradually during the course of infection, reaching a peak two to three weeks after the healing of the lesions and declining by degrees over a period of months thereafter. Immunity from reinfection is established concurrently with allergy during the course of infection, and appears to be closely associated with it. Such immunity likewise undergoes a gradual decline and ultimately loses its capacity for the protection of the animal. Local phenomena of complete immunity associated with diminished allergy can be demonstrated in the lesion sites. The so-called 'id' reactions and accentuated hypersensitivity are probably distinct phenomena, developed and elicited in different ways.

Lampe (P. H. J.). **Over piedra en het vóórkomen van piedra te Batavia.** [On 'piedra' and its occurrence in Batavia.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxxx, 25, pp. 1519–1525, 12 figs., 1940. [English summary.]

Of 120 men and 66 women (natives) examined in Batavia, Java, for 'piedra' of the hair [*R.A.M.*, xx, p. 203], 40 and 3 (33 and 5 per cent.), respectively, were found to be infected by the 'black' form of the disease (*Piedraia*), whereas only one case of the 'white' form (*Trichosporum*) [cf. ibid., xvi, p. 383] was detected.

Lampe (P. H. J.). **Over twee vormen van 'witte' piedra en over het aantoonen van Piedraia in kaliwater.** [On two forms of 'white' piedra and on the detection of *Piedraia* in potash water.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxxx, 44, pp. 2569–2572, 6 figs., 1940.

Besides the well-defined black and white forms of 'piedra' already

reported from Batavia (Java) [see preceding abstract], mention is here made of a third variety, obviously belonging to the white (or rather pale) category since a *Trichosporum* (not yet identified) is consistently isolated from the infected material, but characterized by brown nodules. In one of the two patients affected by this type of 'piedra', the ordinary black nodules developed concurrently with the brown ones. Boedijn has identified the causal organism of the black form as *Piedraia javanica* [*R.A.M.*, xviii, p. 27], the colonies of which on Sabouraud's agar are dark brown to black and almost entirely submerged with frayed edges. The *Trichosporum* colonies from the white nodules are pale yellow to white, superficial, with finely rugose, cerebriform convolutions, while those of the brown form are similar, but of a darker colour and with less rugose and much coarser convolutions.

P. javanica was isolated from one out of some hundreds of cultures of potash water samples from the public baths which are suspected of acting as a source of infection.

Beresova (Mme J. F.) & Naoumova (Mme A. N.). **Bakterielle Methode zur Bekämpfung pilzlicher Krankheiten der landwirtschaftlichen Pflanzen. 1. Saatbakterisation als Mittel zur Bekämpfung von Krankheiten des Leins. 2. Der Einfluss der Saatbakterisation auf den Befall der Keimpflanzen des Sommerweizens mit parasitischen Pilzen und auf seinen Ertrag. 3. Mykolytische Bakterien im Wurzelsystem der Pflanzen.** [A bacterial method for the control of fungous diseases of agricultural plants. 1. Seed 'bacterization' as a means for the control of Flax diseases. 2. The influence of seed 'bacterization' on the infection of Summer Wheat seedlings by parasitic fungi and on the yield of the crop. 3. Mycolytic bacteria in the root system of plants.]—*Микробиол.* [*Microbiol.*], viii, pp. 186–197, 198–205, 695–699, 1939. [Russian. Abs. in *Chem. Zbl.*, cxii (ii), 1, pp. 100–101, 1941.]

Note 1 of this series is contributed by J. F. Beresova, 2 by A. N. Naoumova, and 3 by both authors jointly. In laboratory experiments at the Moscow Institute of Agricultural Microbiology, the increase of germinability of flax seed treated with mycolytic bacteria [cf. *R.A.M.*, xviii, p. 659] amounted to 10 per cent. over the control samples, the corresponding figures for decrease of heavy and milder infection by *Fusarium* [*lini*] being 40 and 19 per cent., respectively; at harvesting the incidence of wilt was 15 per cent. less in the stands from treated seed than in those from non-'bacterized', with a 10 to 12 per cent. heavier yield. B_{17} generally gave the best results of the strains tested, though in some cases F_{24} afforded the maximum stimulus to production. Dry preparations are less apt to injure the seed than liquid ones, peat being preferable to kaolin as a base, except on light sandy soils. Compared with chemical seed treatment, 'bacterization' occupies an intermediate position, being superior to the standard disinfectant PD and somewhat less effective than granosan, which has not yet been put on the market.

Of the bacteria used in experiments for the control of *Fusarium* in summer wheat, F_8 and F_{24} (*Pseudomonas*) and B_{17} (*Achromobacter*) were the most efficacious both for healthy and diseased seed samples,

the percentage of healthy seedlings being raised from 87 to 93 per cent. in the former and from 41 to 48 per cent. in the latter. In pot trials the grain yield was increased by 30 and 29 per cent. by F_{24} and *Az[otobacter] vinelandii*, respectively. The organisms were best applied to the seed-grain in a peat base.

Under similar conditions and in the same soils the number of mycolytic bacteria is larger in the root system of the Leguminosae than in flax and grasses. The bacterial population fluctuates according to the stage of growth of the host, reaching a maximum during flowering. Seed 'bacterization' with strain F_{24} substantially increases the number of mycolytic bacteria in the root systems of flax and wheat.

Muskett (A. E.) & Colhoun (J.). **Prevention of seed-borne diseases in the Flax crop.**—*Nature, Lond.*, cxlviii, 3746, pp. 198–199, 1941.

The seed disinfectant RD7846 (methylthiuram disulphide), with which satisfactory control of seed-borne flax diseases [*Colletotrichum lini* and *Polyspora lini*] has been obtained in Northern Ireland [*R.A.M.*, xx, p. 261], is now known as 'nomersan'. Bulk supplies of the fungicide, secured through the agency of Imperial Chemical Industries, Ltd., and Plant Protection Ltd., were used with machines of the Strickland pattern for the treatment of upwards of 2,000 tons of seed during the season of 1941. Occasional cases of skin irritation through contact with the powder were reported, and protection of the eyes is advisable when sowing. Ceresan U. 564 also gave good results by the short-liquid method, using the Kontramix continuous seed-treating apparatus [ibid., xiv, p. 519]. The crops from seed treated by either method showed good growth with no phytocidal effect.

Tysdal (H. M.) & Kiesselbach (T. A.). **Alfalfa in Nebraska.**—*Bull. Neb. agric. Exp. Sta.* 331, 68 pp., 14 figs., 1 graph, 1941.

In addition to scattered references of phytopathological interest, this bulletin contains (pp. 56–60) a section on lucerne diseases, in the preparation of which the writers were assisted by R. W. Goss and J. H. Jensen. Tables are given on pp. 28–30 summarizing the data obtained in all the controlled bacterial wilt (*Phytomonas insidiosa*) [*Aplanobacter insidiosum*] varietal tests carried out in Nebraska from 1929 to 1938, from which it appears that the Turkistans are greatly superior, both in stand survival and resistance to the pathogen, to most of the strains comprising the Common, Spanish, and Chilean groups, with the exception of the newer varieties, such as Hardistan, Orestan, and possibly Ladak [*R.A.M.*, xx, p. 472]. Biennial rotation delayed the development of the disease, but failed to eliminate the causal organism.

Notes are also given on the leaf spots, *Pseudopeziza medicaginis*, *Pyrenopeziza medicaginis*, and *Ascochyta* spp., stem blight (*Pseudomonas medicaginis*), and rust (*Uromyces striatus*).

Sullivan (J. T.) & Chilton (S. J. P.). **The effect of leaf rust on the carotene content of white Clover.**—*Phytopathology*, xxxi, 6, pp. 554–557, 1941.

Comparative analysis at the United States Regional Pasture Research Laboratory, State College, Pennsylvania, of the carotene contents and thus the potential vitamin A activity of white clover (*Trifolium*

repens) leaves infected by rust (*Uromyces trifolii* [var.] *trifolii-repentis* [*U. trifolii-repentis*: *R.A.M.*, xiv, p. 241]) and those of adjacent plants protected by sulphur dust showed the former to contain 21 per cent. less than the latter. Where no rust was present the treatment reduced the carotene content of the foliage by 10 per cent. Heavily and lightly infected leaves averaged 45 and 24 per cent. less carotene, respectively, than healthy ones on the same plant.

Hirschhorn (Elisa). **Nota sobre 'Ustilago bullata'.** [A note on *Ustilago bullata*.]—*Rev. argent. Agron.*, viii, 2, pp. 160–164, 1 fig., 1941.

Following a summary of Fischer's recent studies on physiologic specialization in *Ustilago bullata* on grasses in the United States [*R.A.M.*, xx, p. 347], the writer makes some observations on promycelial development in isolations of the smut from *Hordeum* and *Bromus* spp. in Neuquén, Argentina: (1) from *H. jubatum* produces numerous uni- to bicellular promycelia with an abundance of sporidia of uniform shape and diameter; (2) from *H. compressum* is characterized by bi- to quadricellular promycelia with few sporidia, the length and septation of which differ from those of any of the other collections hitherto made; (3) from *B. macranthus* gives rise to very short, bicellular promycelia, the cellular fusions being effected by means of a tube; (4) from *B. mollis* likewise produces short uni- or bi-, in one case tricellular promycelia; and (5) from *B. unioloides* is characterized by stout, bicellular promycelia with numerous sporidia and fused sporidia. Differences such as the foregoing in the dimensions and number of promycelial cells may well serve as an additional diagnostic character for the various physiologic races of *U. bullata*.

Fischer (G. W.) & Levine (M. N.). **Summary of the recorded data on the reaction of wild and cultivated grasses to stem rust (Puccinia graminis), leaf rust (P. rubigo-vera), stripe rust (P. glumarum), and crown rust (P. coronata) in the United States and Canada.**—*Plant Dis. Reptr Suppl.* 130, 30 pp., 1941. [Mimeographed.]

In view of the interest taken in the United States and Canada in the improvement in local grasses through breeding, selection, and disease control, the authors have brought together a considerable mass of material (much of it previously unpublished) on the reaction of these grasses to rusts (*Puccinia* spp.). This material they present in the form of two tables, one of which summarizes the records of the known reactions of 350 species of native and introduced grasses in the United States and Canada to *P. graminis*, *P. rubigo-vera* [*R.A.M.*, xii, p. 499], *P. glumarum*, and *P. coronata*, while in the second the results are presented for *P. graminis agrostidis*, *P. graminis avenae*, *P. graminis phlei-pratensis*, *P. graminis poae*, *P. graminis secalis*, and *P. graminis tritici*. These tables are followed by a bibliography of 93 titles, showing the sources of the published data given in the tables.

Ivanoff (S. S.). & Keitt (G. W.). **Relations of nectar concentration to growth of Erwinia amylovora and fire blight infection of Apple and Pear blossoms.**—*J. agric. Res.*, lxii, 12, pp. 733–743, 1941.

In experiments in Wisconsin, fireblight bacteria (*Erwinia amylovora*)

[*R.A.M.*, xvii, p. 48] grew best in 2 to 4 per cent. concentrations of sugar in 1/400-cc. drops of artificial nectar in van Tieghem cells, their growth decreasing rapidly with increased sugar concentration, none occurring at 30 per cent. In nectar drops containing 20, 30, and 40 to 50 per cent. sugars the bacteria survived for 48, 24, and less than 24 hours, respectively. When test-tubes partly filled with artificial nectar solution containing 40 per cent. sugar were heavily seeded, enough bacteria survived for 72 hours to induce infection in pear blossoms. In greenhouse infection experiments with potted dwarf Bartlett pear trees, 10 bacteria in a 1/400-cc. water drop were found to constitute a highly efficient inoculum causing 66 per cent. of blossom infections as compared with 91 and 93 per cent. caused by 100 and 1,000 bacteria in the drop, respectively. Sugar concentrations in nectar under natural conditions in orchards during May and June were recorded by means of an Abbé refractometer. The limited data obtained show the strong predominance of nectar concentrations that would preclude multiplication of the bacteria and would be unfavourable for their survival. The early morning readings showed concentrations favourable for infection, while those taken later in the day usually did not. In field experiments where the unwounded pear and apple blossoms were inoculated with droplets of bacterial suspensions in artificial nectar solutions, infection occurred freely at low concentrations of nectar (1 to about 5 per cent.), but was rare or absent at high concentrations (40 per cent.). However, infection occurred somewhat later when the concentrated nectar was sufficiently diluted by some natural process soon enough after inoculation.

Keitt (G. W.) & Ivanoff (S. S.). **Transmission of fire blight by bees and its relation to nectar concentration of Apple and Pear blossoms.**—*J. agric. Res.*, lxii, 12, pp. 745–753, 1 fig., 1941.

In Wisconsin experiments transmission of fireblight bacteria, (*Erwinia amylovora*) [see preceding abstract], from contaminated to healthy pear and apple blossoms by honey bees was demonstrated by three different methods, the most successful involving the use of individual bees handled in a specially designed wire cage. The bees were attracted to diseased blossoms on a tree inoculated five days earlier and transmitted the disease therefrom to healthy blossoms. In a greenhouse trial contaminated bees freely transmitted fireblight to healthy blossoms when the sugar concentration of the nectar ranged from 2 to 8 per cent., but not when it was 45 per cent. or higher. In the field, where bees were allowed to sip nectar containing 2 to 12 per cent. sugars from inoculated blossoms and then from uncontaminated ones with nectar containing 0 to 35 per cent., 49 per cent. of the blossoms became diseased. On the other hand, no infection resulted when the nectars of inoculated blossoms contained 10 to 14, 42 to 56, or 48 to 75 per cent. sugars, respectively, and that of healthy ones 10 to 18, 44 to 47, and 46 to 70 per cent., respectively. These results indicate that nectar concentration is a very important factor limiting blossom blight transmission by bees. However, since no infection occurred in many cases in which nectar was at a favourable concentration, it is concluded that there may be also some other limiting factors.

PERLBERGER (J.). **A heart-rot of Apple trees caused by Diplodia sp.**—Reprinted from *Palest. J. Bot.*, R Ser., iii, 1–2, 3 pp., 1 fig., 1940.

A species of *Diplodia*, characterized by single pycnidia, averaging 300 to 500 by 200 to 500 μ, and thick-walled, elliptical, brown, striate, uniseptate spores, 16·4 to 23·4 by 11 to 16·5 (average 19 to 22 by 13·75) μ, was isolated from the rotted brown heart wood of Duchess of Oldenburg and Grand Alexander apple trees prepared for top-working with another variety in the winters of 1938–9 and 1939–40 near Rehovot, Palestine. This appears to be the first record of a *Diplodia* in connexion with a heart wood rot of deciduous fruit trees. The spores of the pathogen were compared with those of *D. griffoni*, reported as an agent of bark canker and die-back of apple trees in New Zealand [*R.A.M.*, iii, p. 340] and England [ibid., iii, p. 43], respectively, and found to be distinct, whereas they closely resembled those of a species of *Diplodia* isolated from citrus trees and fruits by F. Littauer, who inoculated the author's fungus into citrus fruits and produced the typical stem-end rot associated with *D. natalensis* in Palestine [ibid., xix, p. 88]. Pending further investigations, however, the apple-rotting organism is not definitely identified. Apple wood is penetrated much more deeply (80 to 120 cm. from the point of infection) than that of citrus.

KESSLER (H.). **Schlussfolgerungen aus einem Lagerungsversuch mit der Sorte Schöner von Boskoop.** [Conclusions from a storage experiment with the Beauty of Boskoop variety.]—*Schweiz. Z. Obst-u. Weinb.*, l, 13, pp. 279–284, 1 graph, 1941.

After approximately 5½ months' storage (October to April, 1940–1), the loss due to [unspecified] fungal decay, internal breakdown, and severe skin browning [? scald] in Beauty of Boskoop apples harvested on 5th October and stored at ordinary cellar temperature amounted respectively, to 3, 0, and 0 per cent., for one tree, 29, 0, and 4 per cent. for another, and 52, 0, and 2 per cent. for a third, the corresponding figures for fruit stored at 4° being 3, 0, and 0; 21, 0, and 3; and 31, 0, and 4, respectively, and for that stored at 0°, 5, 17, and 0; 8, 44, and 0; and 23, 30, and 0, respectively. For fruit from the first tree, harvested on the 21st October, the percentages were 1, 0, and 0 at ordinary cellar temperature; 6, 0, and 3 at 4°; and 2, 13, and 0 at 0°. It is apparent from these data that a constant temperature of 4° is most conducive to the maintenance of soundness during storage in the variety in question, a conclusion not new, but one on which it is necessary to insist in view of the prevalent Swiss practice of storing Beauty of Boskoops at 0° to 1°.

MCWHORTER (O. T.). **Sulphur dust, spray controls brown rot.**—*Bett. Fruit*, xxxvi, 1, pp. 5, 13, 1941.

Under Oregon conditions, control of brown rot of stone fruits [*Sclerotinia fructicola* and *S. laxa*: *R.A.M.*, xix, p. 550] is advised by sulphur dusting or wettable spray, using a brand of sulphur at least fine enough to pass through a 325-mesh screen. About ½ lb. of dust (not less) is required for each tree. Wettable sulphurs are applied at the rate of 6 lb. per 100 gals., the entire tree being covered, especially the centre. Treatment should be effected whenever infection appears on the developing fruit, at any

time after the beginning of July. If rain falls soon after the application, another must be made.

To protect peaches before and at harvest time, treatment should be effected five weeks before ripening and again 10 and 20 days later. This gave excellent control in 1940.

Willison (R. S.). **Studies in maturity and cold storage of Peaches.**—*Sci. Agric.*, xxi, 10, pp. 624–645, 5 graphs, 1941.

In studies on the effect of temperature on the keeping quality of peaches in storage, tests were made at 45° and 33° F. during four seasons with the early variety Rochester and the late variety Elberta, and during three seasons with the mid-season varieties Valiant and Vedette.

Internal breakdown generally was of the diffuse or invasive kind, and usually began with the appearance of minute bubbles in the intercellular spaces of the flesh, from about $\frac{1}{16}$ in. beneath the skin inwards, and advanced towards the pit until the entire flesh was affected. Aeration of the flesh was often accompanied or succeeded by a pink discoloration which rapidly changed to brown. This flesh-reddening was noted in stored peaches, but usually developed in lots removed to room temperature after prolonged exposure to cold. In some cases breakdown was so rapid that internal browning was the first sign of trouble. When invasive internal browning had set in, the affected areas became discernible through the skin, and the fruit felt spongy and dead. At first, breakdown slightly increased the resistance of the flesh to pressure, and made cutting of the flesh with a knife audible. After the peaches had been in cold storage for some time, especially at 33°, the onset of breakdown was expedited by raising the temperature of the fruit. In non-cooled peaches kept at room temperature, physiological breakdown either did not occur, or it was concealed by internal fungal decay developing three to four weeks after picking from mould infection [unspecified] through the stem scar.

A second radiating form of internal browning, less common and less extensive than the invasive type, began at the pit and progressed outwards through the flesh. In some years, browning was preceded by a reddish line in the flesh next to the pit, or by reddish streaks radiating through the flesh from the vicinity of the pit suture. This type of breakdown occurred most frequently in the Elberta variety.

Small, injected, water-soaked areas also developed near the pit suture or partly or completely round the pit, particularly in Elberta peaches. This condition was found in fruit long in storage, but it also developed on peaches left on the trees until over-ripe. In advanced stages, the injected tissues dried out into a series of lenticular cavities in the flesh next to the pit; this generally occurred when the flesh was badly affected by invasive breakdown.

Mealiness is regarded as a form of breakdown or as the forerunner of invasive breakdown.

The Elberta variety showed internal breakdown after 3 to $4\frac{1}{2}$ weeks at 45° and after 7 to $7\frac{1}{2}$ weeks at 33°. With Rochester peaches the time of commencement of browning varied more with the season and with ripeness at picking and ranged from after 5 to 9 weeks at 45° and 9 to 12

weeks at 33°. In general, the riper grades of peaches broke down earlier than green ones of the same pick. As a rule, discoloration developed sooner after removal from 45° than after the same storage period at 33°. As regards susceptibility to breakdown Vedette and Valiant were intermediate between Elberta and Rochester. The latter was more tolerant to storage at 33° than the former.

THORNBERRY (H. H.) & ANDERSON (H. W.). **Overwintering of bacterial spot on Peach.**—*Plant Dis. Reptr*, xxv, 9, pp. 268–269, 1941. [Mimeographed.]

Details are given of observations in various parts of Illinois supporting the writers' opinion, already expressed in 1933 [*R.A.M.*, xiii, p. 172], that *Phytomonas* [*Xanthomonas*] *pruni* overwinters in peach twigs, primary foliar attacks originating from the inoculum in spring cankers and twig infections probably remaining dormant from the autumn until the spring. Spring cankers developing on the past season's shoots have been consistently found to act as the source of primary leaf infections under local conditions in the State during the last ten years. Such cankers, owing to their scarcity and inconspicuousness, are difficult to detect, but they generally occur on the distal third of watersprouts arising from the trunk or main branches, though occasionally to be found on the terminal shoot of ordinary branches. Young, luxuriantly growing trees may bear from one to five cankers per tree in cases of severe foliar infection.

HILDEBRAND (E. M.). **Rapid transmission of yellow-red virosis in Peach.**—*Contr. Boyce Thompson Inst.*, ii, 6, pp. 485–496, 4 figs., 1941.

In greenhouse and orchard experiments carried out during 1939–40 at the Boyce Thompson Institute, New York, the virus of yellow-red virosis or 'X' disease [*R.A.M.*, xx, p. 310] was transmitted by budding from peach to peach. The symptoms, which otherwise failed to appear three months after inoculation, appeared within a month when the inoculated trees were topped, this operation apparently liberating the virus from the diseased buds and accelerating its spread through the plant. It is suggested that this rapid method of transmission may also be adapted to the study of other viruses.

HILDEBRAND (A. A.) & WEST (P. M.). **Strawberry root rot in relation to microbiological changes induced in root rot soil by the incorporation of certain cover crops.**—*Canad. J. Res.*, Sect. C, xix, 6, pp. 183–198, 1 pl., 1 diag., 1941.

In pot experiments carried out in Canada during 1936 to 1939, strawberry plants of the variety Premier were grown in naturally infected root rot [*R.A.M.*, xviii, p. 809] soil on which various cover crops had been previously grown and turned under, as well as in the same soil steam-sterilized or fertilized with farmyard manure. The results showed that strawberry plants grown in steam-sterilized soil or soil into which soy-bean had been incorporated, remained free from disease until the third season when they exhibited slight infection, whereas plants in the manure, maize, red clover, timothy, and untreated soil series all became

diseased, the severity of infection increasing in the respective series in the order named. Microscopic examination of roots of various cover crops showed that although several different genera and species of fungi were present in all, each plant favoured a specific fungus more than others. Thus, in the tomato series, out of a total infection value for fungi of 965, a value of 794 was assigned to *Rhizoctonia* [*Corticium*] *solani*, while in the soy-bean series, a value of 2,695 out of a total of 2,733 was assigned to *Thielaviopsis basicola*, and in the maize series a value of 1,483 out of a total value of 2,555 was due to *Pythium* spp. There seemed to be a correlation between the presence of these specific organisms and the incidence and the severity of the disease in the roots of the strawberry plants subsequently raised, but on the other hand, in strawberry plants grown in the variously treated soils fungal infection was negligible and apparently not related to that of the preceding cover crop. The only exception to this was the heavy infection ascribed to the mycorrhizal fungus (? *Rhizophagus* sp.) following timothy and maize, but certain inconsistencies suggested that other agencies might be responsible for the injuries. The root surfaces of healthy plants were found to harbour fewer bacteria than those of diseased ones, while the surrounding soil contained approximately equal numbers. Qualitative analyses of the bacterial groups differentiated on the basis of nutritional requirements indicated a striking relationship between the incidence of certain groups and the severity of the disease: for example, bacteria of group 3 accounted for 51·9 per cent. of all organisms on the roots of badly diseased plants, but supplied only 2·3 per cent. of those present in sterilized soil. On the other hand, bacterial groups 5, 7, and 9 comprised 46·4 per cent. of the bacterial population of healthiest roots and only 5·4 per cent. of that from severely infected plants. The equilibrium between the presumably harmful bacteria and the innocuous ones is designated the 'bacterial balance index'. The equilibrium of the different soil series showed marked differences, the lowest bacterial balance index being associated with increased severity of root rot.

West (P. M.) & Hildebrand (A. A.). **The microbiological balance of Strawberry root rot soil as related to the rhizosphere and decomposition effects of certain cover crops.**—*Canad. J. Res.*, Sect. C, xix, 6, pp. 199–210, 1 pl., 1 graph, 1941.

In further experiments on the microbiological balance of soil infested with strawberry root rot [see preceding abstract], soy-bean grown as a cover crop and incorporated into such soil induced a striking reduction in the incidence of root rot in the subsequent strawberry crop and caused a drastic change in the bacterial equilibrium of the soil; red clover had little effect on the severity of the disease or the general microbiological balance of the soil. It was demonstrated that these characteristic effects were not produced by the two cover crops while in the living state. A study of the bacteriological aspects of their decomposition, on the other hand, showed that the breakdown of the two crops under identical conditions was strikingly different, the soy-bean apparently undergoing a predominantly carbohydrate fermentation that could be reproduced in culture by the substitution of glucose for soy-bean tissues, whereas the decomposition of red clover was chiefly

putrefactive. Beneficial changes in the bacteriology of actual root-rot soils could be induced by the decomposition of pure carbohydrate in place of soy-bean. The bacterial balance was altered by the decomposed soy-bean in such a way that potentially harmful organisms were replaced by harmless ones. Strawberry plants grown in soils treated with carbohydrate produced well-developed, healthy root systems. It thus appears that the ability of soy-bean to control strawberry root rot depends primarily on a carbohydrate type of decomposition which causes a highly favourable shift in the microbiological equilibrium of the soil.

CONDIT (I. J.) & HORNE (W. T.). **Further work on Fig mosaic.**—*Phytopathology*, xxxi, 6, pp. 561–563, 2 figs., 1941.

In the southern and eastern United States fig mosaic appears to be virtually restricted to California [*R.A.M.*, xiii, p. 252], where it is spreading to *Ficus altissima*, *F. krishna*, and *F. tsiela*. It is also present in Texas, while other countries affected include England, Puerto Rico, China, New South Wales, and Western Australia. A foliar discoloration or spotting (possibly a deficiency symptom) and a form of little leaf of *F. glomerata* have been observed in California. The name *Ficivir caricae*, based on Fawcett's recent proposals for virus classification [ibid., xx, p. 174], is suggested for the fig mosaic virus.

NISIKADO (Y.), HIRATA (K.), & KIMURA (K.). **On a Phytophthora rot of Fig.**—*Ber. Ōhara Inst.*, viii, 4, pp. 427–442, 4 pl., 1 graph, 1941.

In 1935 the first severe epidemic of *Phytophthora* rot of figs occurred in the Kurasiki region of Japan, the White Genoa variety being chiefly affected. The disease was first observed in 1909 by K. Hara, who in 1915 applied the name of *Kawakamia carica* to the causal organism; in 1915 it was detected by S. Hori on the California Black variety and referred to *P. fici* (subsequently changed to *P. carica*); K. Sawada found the same fungus, also on California Black, in Formosa in 1914 (*Trans. nat. Hist. Soc. Formosa*, xxvi, pp. 174–179, 1916), while in 1935 S. Takimoto discovered it not only on the fruit, but also on the leaves, young stems, and leaf sheaths. Both Tucker [*R.A.M.*, x, p. 755] and Leonian [ibid., xiv, p. 398] regard *P. carica* as a synonym of *P. palmivora*, and the present writers adopt the same view. The hyaline, piriform, oblong, ellipsoid, ovoid, or fusoid conidia of their isolation measured 27 to 87 by 17 to 45 μ, compared with 27 to 72 by 20 to 53 μ for *P. palmivora*.

The pathogen thrives in an atmosphere of extreme humidity such as prevails locally during the rainy season from May or June until the late autumn. Affected fruits turn dark green or deep purple according to the variety and present a water-soaked appearance, finally softening and dropping or, if drier conditions supervene, remaining on the tree in a mummified state. On the foliage the irregular lesions rapidly change from light to dark brown and soon cover half the surface in young leaves, but in older ones they seldom exceed 2 to 3 mm.

Inoculation experiments with pure cultures of the fig strain of *P. palmivora* gave positive results on wounded and uninjured fruits, leaves, and buds of figs, as well as on pear, apple, persimmon, tomato, and egg-

plant fruits, and potato tubers, though in the case of the last-named the symptoms were less pronounced than those induced by *P. melongenae*.

The minimum, optimum, and maximum temperatures for the growth of the fungus on potato dextrose agar were found to be from 5° to 10°, 27°, and 32° to 33° C., respectively. Slight desiccation and movement of air above the cultures were conducive to conidial production, but the sexual stage of the organism failed to develop even on Leonian's green pea decoction medium [ibid., xv, p. 597].

MEREDITH (C. H.). **The effect of sodium nitrate on Fusarium oxysporum cubense.**—*Phytopathology*, xxxi, 6, p. 564, 1941.

Croucher and Mitchell (*Bull. Dep. Sci. Agric. Jamaica* 19, 1940) have recommended the monthly application of sodium nitrate at the rate of 2 oz. per root near the root head for the control of Panama disease of bananas (*Fusarium oxysporum* [var.] *cubense*) in Jamaica. In tests to determine the effect of the compound on the pathogen, the spores were inactivated by the admixture of 16·6 parts to 83·4 parts of soil culture, only a few recovering sufficiently to germinate on transference to rice agar. The incorporation with clay soil of 3·125 per cent. sodium nitrate completely inhibited penetration by the *Fusarium*, while 1·538 per cent. of the fertilizer reduced the penetration from 4·1 to 2·7 cm. after 16 days.

PARRIS (G. K.) & JONES (W. W.). **The use of methyl bromide as a means of detecting latent infections by Colletotrichum spp.**—*Phytopathology*, xxxi, 6, pp. 570–571, 1 fig., 1941.

During the few days required for ripening by Hawaiian papaws treated against insect pests with methyl bromide and held at 50° F. for six days, anthracnose (*Colletotrichum* ? *gloeosporioides*) [*R.A.M.*, xix, p. 294] develops rapidly, whereas untreated fruits show little infection. Similarly, Lualualei string beans (*Phaseolus vulgaris*) subjected to the same treatment were severely rotted, not only by *C. lindemuthianum*, but also by secondary invaders (*Fusarium* and *Alternaria* spp.). These observations suggest that methyl bromide may be a useful agent in the determination of susceptibility to fungal infections which would otherwise remain latent.

MCCALLAN (S. E. A.), WELLMAN (R. H.), and WILCOXON (F.). **An analysis of factors causing variations in spore germination tests of fungicides. III. Slope of toxicity curves, replicate tests, and fungi.**—*Contr. Boyce Thompson Inst.*, xii, 1, pp. 49–78, 7 graphs, 1941.

In a further contribution to this series [*R.A.M.*, xx, p. 27] the results are given of laboratory tests of 20 compounds, representing heavy metals, commercial 'insoluble' copper fungicides, and synthetic organic materials, on *Sclerotinia fructicola*, *Glomerella cingulata*, *Alternaria solani*, *Macrosporium* [*Stemphylium*] *sarciniforme*, *Botrytis* sp. (*cinerea* type), and *Rhizopus nigricans*. The 718 individual toxicity curves obtained showed four different, reasonably constant slopes on logarithmic probability paper: (*a*) a simple straight line, (*b*) a double slope with left-hand 'break' in lower values giving a curve concave upwards, (*c*) a double slope with right-hand 'break' in upper values, or curve convex upwards, and (*d*) a triple slope or sigmoid curve, 17 per cent. of the curves being of the two latter types. The type and steepness of slope

were determined more by the compound than the fungus. It is suggested that heterogeneous compounds differing widely in slope as well as compounds of convex and sigmoid type curves should be evaluated at high LD levels [ibid., xix, p. 665] such as the LD 95. Highly significant correlations were observed between steepness of slope and toxicity at the LD 50 point for straight and concave type obtained in the heavy metal and copper series; no correlation was observed among the organic materials. The rapid graphic method of obtaining LD values was shown to give as satisfactory results as the long method of calculation and the use of the former is accordingly recommended for general comparisons.

The variations in results obtained in replicate tests were found to be due mainly to the use of different lots of fungous spores rather than to differences in the fungicidal dose. A linear relation exists between the logarithms of LD 50 and of the number of spores exposed to the fungicide. Errors in adjusting the concentration of a spore suspension for a given test account for only a small portion of the variance of replicated tests. Different fungicides may be rated approximately in terms of a standard, provided they are of essentially similar slope and chemical composition. All the fungi tested were alike in their average sensitivity to a number of fungicides, except for *R. nigricans*, which was significantly more sensitive. There was no evidence that the average sensitivity was inversely proportional to the spore volume. The fungi differed, however, in their sensitivity to specific compounds, the greatest tendency to rate them differently being displayed by *A. solani* and *Sclerotinia fructicola*. As regards reproducibility of results, ease of counting, and ready production of spores in quantity, which are considered to be the three main criteria for the selection of fungi for laboratory tests, *A. solani* and *S. fructicola* are considered the most suitable, *Stemphylium sarciniforme* and *G. cingulata* fairly so, and *B. cinerea* and *R. nigricans* generally unsatisfactory.

To give the maximum testing efficiency the following experimental design should be followed: four or five different doses; dose ratios of 2,000 or 1,414; 100 spores per count per dose; no replicate counts; graphic methods of determining LD values; evaluation at LD 50 for straight line or concave type compounds having similar slopes, and at LD 95 for dissimilar slopes and curves of convex or sigmoid type; several different fungi tested twice rather than one fungus tested a number of times; and for error term, the compound × replicate tests interaction.

Gold Coast. Regulations made under the Plant Pests and Diseases Ordinance, 1937.—2 pp., 1941.

Order No. 12 of 1941, to be cited as the Swollen Shoot Disease of Cacao Order, 1941 [cf. *R.A.M.*, xx, p. 47] dated 20th and gazetted 23rd May, 1941, defines the area declared to be in danger of infection, occupiers of farms lying wholly or partly within which shall, within 90 days of the coming into effect of the Order, remove all cacao plants from their land unless exempted in writing by the Director of Agriculture, whose permission is further required for the planting of cacao within the prohibited area. Regulations No. 41 of 1941 of 27th June, 1941, are concerned with amendments in the territorial definitions of the infected area.